stonexus
MAGAZINE

EDITOR
TOMAS LIPPS

DESIGN & PRODUCTION
TOMAS LIPPS
FAITH EASTHEIMER
JOHN PAUL RANGEL

Printed and published in the USA by
THE STONE FOUNDATION SOCIETY
116 Lovato Lane, Santa Fe NM USA 87505
www.stonefoundation.org
email: tomas@stonefoundation.org
telephone/fax: 505-989-4644

stone (ston) n.
1. a. Concreted earthy or mineral matter; rock.
b. Such concreted matter of a particular type. Often used in combination.
2. A small piece of rock.
3. Rock or a piece of rock shaped or finished for a particular purpose,especially:
a. A piece of rock that is used in construction.
b. A gravestone or tombstone.
c. A grindstone, millstone, or whetstone.
d. A milestone or boundary.

nex-us (nek' sas) n., pl. nexus or nex-us-es.
1. A means of connection; a link or tie.
2. A connected series or group.
3. The core or center.

mag-a-zine (mag-úh-zeen), n.
1. A periodical containing a collection of articles, stories, pictures, or other features

Front cover photograph by Bill Braswell
Back cover photograph by Anne Jeffery, New Mexico Bureau of Land Management

Hello Mr. Lipps,

I have been searching for information regarding stone cutting. This search has been going on for years. I finally hit gold when I saw a part of your letter via a search through google.com. I quickly joined the Stone Group in Freelists. This site took me to your Stone Foundation Site. I have printed your application and will send it soon.

I am the grandson of a stone cutter and thought this trade was all but lost. I have broken many chisels trying to hone stone. Also have been searching for plans to build a wire saw. No one I have contacted has any idea how these saws operate or are built. Can you point me in the right direction?

I am looking to use simple parts that were used years ago.

Sincerely,
Dan Condon
Tomkins Cove, NY

---

to <Tomas@stonefoundation.org>

nice page

just wanted to say hello, from schoharie co. ny. im alocal stone mason carver ,sculptor, and all around stone effienado(?) been at this since i was a young kid. built stone forts as apposed totree houses. my first collapesedon me , tony depasqually came to my rescue.

mark swanberry
New York

---

to <Tomas@stonefoundation.org>

At last! Your web site is like an unexpected oasis in a desert of despair. I would love to get more information about the work you are doing and about your 2001 symposium.

I work for a municipal government in a large shelter for homeless men. On the weekends and holidays I practice blacksmithing and stone masonry. Thanks for the web page, it is wonderful.

Toby Druce
Toronto

The following is an exchange between the Stonexus editor and a professor of architecture and an advocate of sustainable building materials:

Hello Tom Hahn,

I was interested to visit your site (you seem to have been as busy as three people), but it left me wondering: do you not consider stone to be a sustainable architectural material? particularly in the desert regions of which you speak where it is often abundant? where straw bales must be imported?

Respectfully,

Tomas Lipps

Hello Tomas - Thanks for contacting me about stone and sustainability. I have several thoughts to share with you...

Yes, stone is an incredibly durable, plentiful, natural and naturally beautiful material. It is time-tested and weathers with grace (generally). It is, perhaps, the most structurally strong building material (in compression) known to humans, the capability of which has been shown throughout time in many of the greatest ancient buildings. It makes a great deal of sense where zero-maintenance for the life of a building is essential (in a high-rise, for example). It also has vast potential as aggregate in both structural and finish materials, when mixed with various cementitious and adhesive binders, and can be very simply and attractively used when "seeded" as a finish into and onto a variety of panelized building systems.

However, though it is a natural, plentiful material, it is a non-renewable resource, whose supply will reach its practical limit eventually. And the quarrying and mining necessary to extract most stone can be terribly destructive to the landscape, to watersheds and natural habitats, leaving scars that will long outlive the buildings for which the stone was extracted.

And it is more and more frequently used on buildings where the intended life-span for occupancy is much, much less than the stone itself, meaning it is demolished before its durability value even becomes an issue. Stone can also be very difficult to recycle or reuse in any meaningful way,

often being demolished and simply dumped as landfill for erosion control.

Furthermore, stone is often heavy and costly - in money, energy, and pollution - to transport. And though often quarried locally, it is also often shipped long distances for processing and finishing. I have heard the story of a "green" building project in the north central states where the architect conscientiously wanted to use stone from a local quarry, a few miles down the road from the site, to clad the building. When the finished stone arrived, he was dismayed to find out it had, indeed, been quarried a few miles away, but was then loaded on a train, taken to the Great Lakes, loaded on a ship, taken to Italy, where it was milled to his specifications (which weren't extravagant), then shipped back to New York, taken by rail to Pittsburgh for anchor attachment, then finally returned to the project site by truck. Granted, this story may well be "urban legend" but it's not necessarily implausible or unique.

Lastly, "traditional" stone is now often limited (by building codes and structural engineers) to a single purpose in contemporary buildings - simply being used as a "cosmetic" veneer over another building system. In smaller scale buildings, this other building system is often concrete block, or pre-cast or site-cast concrete, both of which can be made "beautiful" as a finish themselves, and thereby serve multiple purposes for a building (structure, finish, even insulation). In larger buildings, stone is often used over steel and concrete structural frames, both of which can employ a wide array of other cladding systems that are lighter, more flexible in detailing, more insulative, more recyclable, and in certain cases, just as durable.

In contrast, you mention straw-bale construction in your message. Interestingly enough, crops that produce suitable "straw" for building (wheat, oats, barley, rice, rye grass) are grown in nearly every region of the country, including throughout southwestern Arizona. Further, straw is a renewable resource, with enough straw grown _every year_ in the US to build the walls of every house built every year in America, five times over. Straw is also a recovered waste resource, being the by-product of the growing of grains for other uses including bread, cereal, beer, etc., unlike wood (and stone) and other materials, which are extracted for a single purpose - building. Straw has amazing thermal and sound insulation properties, and has basic structural capabilities, suitable for most small scale buildings. It is relatively light, and very inexpensive. It is, however, susceptible to moisture degradation, its thickness takes up substantial space on a site, as a system it requires extensive plastering/stuccoing for finish, and takes considerable effort to detail properly, among other challenges it faces when used in buildings.

In the end, however, straw and stone are just two of many materials and systems to consider when designing a building, about which the decision should be based on environment, place, culture, cost, program and a whole host of other factors. I strive, in my practice and university teaching, to consider and present the pros and cons, as I understand them, of those many systems and materials, and I carry an ongoing commitment to learn as much as possible about every building system I come across.

If you have more to share with me about stone as a building material relative to the environment, please feel free to reach me at any of the contact points listed in the signature block below. Thanks again for writing to me.

Best regards,

Tom Hahn
University of Arizona

Dear Editor:

The Dry Stone Conservancy is collecting information from dry stone masons, engineers, landscape architects, and architects on the subject of canted foundations in retaining walls. We would like to request of your readers whether they ever build a canted, or sloped, foundation? And if so, under what conditions? Thanks very much for giving us the opportunity to request this information. We will be glad to send a report to all who would like to have one.

Very sincerely yours,

Carolyn Murray-Wooley,
Director, Dry Stone Conservancy
Lexington, KY

To the Editior,

In an age, when the marketplace is constantly reacting to the latest trend, it is refreshing to see that excellent stonework perpetually remains in style. However, defining what constitutes quality stone and excellent stonework is something that is not clearly documented or understood. I have been involved in the stone masonry industry for the last 32 years and have seen a lot of stonework that includes a variety of different styles and methods of stone construction. Questions arise as to what comprises quality work in terms of the use and selection of materials as well as the setting style and the look of the finished product. The answer to these questions for the end user is usually what the architect, builder, or mason presents. While stonemason's who regularly work with stone can visualize what the finished project will look like, it is often a time-consuming and frustrating educational process when working with end users and other professionals as to what is acceptable in stone construction.

Stonemasons are by nature independent, and up until this point as a group have not identified or communicated what constitutes quality stonework. The Stone Foundation has an excellent opportunity to set the bar and define the standards for acceptable material selection and workmanship. While there are bits and pieces of information available about stone installation, and what makes up good stone for specific applications; there is nothing that I am aware of, that pulls all of this together in a comprehensive set of standards. We have a real opportunity as an organization to adopt best practices for installation, quality for stones, and selection of stone for the right applications. While some aspects of stonework are subjective and may not be easily documented, creating such standards will reinforce the best practices that are currently being used and educate architects, specifiers, and end-users. Furthermore, the awareness that this education will bring will most certainly increase the use of stone in construction as professionals and consumers grow more familiar and comfortable with the concept of stone in their environment.

I currently buy stone products from different areas throughout the country and am very interested in setting higher standards for all of our stone products. Our company supports this effort by the creation of written specs on the products we market. These specs are used to educate our employees and sales representatives and are also an excellent tool for architects, specifies, and end users. I know how critical this work is to our business and I am sure that many of you are also frustrated by the lack of consolidated information on stone masonry in the marketplace.

I propose that the Stone Foundation adopt a set of standards that would include characteristics of quality stone, recommended and approved installation practices, and best practices of workmanship and style. Perhaps interested members of the foundation can create a standards team that evaluates existing practices, determines a best practices in stone masonry reference guide, and publishes this work nationally. I welcome any and all feedback on these areas.

David Hisey

Director of Procurement
Architectural Stone Division
Luck Stone Corporation

Letter FROM the editor:

Does anyone know of a book written by a couple who built a stone residence from a Frank Lloyd Wright design. This was somewhere in the midwest, Wisconsin perhaps. The stone mason in charge was an interesting character named Jimmy, or Johnny - something like that. He had the fastidiousness of an ex-navy man or a Japanese artisan; every day when he began work he would don a new pair of white cloth gloves and at the end of each day's work would toss them in the trash. When the job was finished the owners noticed a spot of white high up on a wall. When asked, Jimmy (or Johnny) identified it as a cube of white marble the like of which he incorporated in every wall he built as a sort of signature or trademark I,d like to read more about this guy and make it possible for others to do so by reprinting portions of this book.

Tomas

stonexus

STONEXUS, the magazine - OUR magazine, is here made manifest.

What was an idea a year ago is a present day reality. You have in your hands the first issue, the prototype, the working model from which STONEXUS will evolve.

The intention has been to create something both interesting and informative. Please communicate what you think about the magazine and the various elements of which it is composed. Letters of comment and criticism are not only welcome, they are requested.

Requested as well are suggestions about material for future issues. Several of the interesting articles in this issue have been previously published and, but for their appearance here, would not have come to your notice. Readers are encouraged to recommend articles from other magazines or journals, excerpts from books or other publications on interesting aspects of the craft of stonework. Graphics too; photographs and drawings sent in will be considered for inclusion

STONEXUS is an in-house publication. Most of the articles in this first issue are original material, written by STONE FOUNDATION members. Outlines of proposed articles and/or original photographs,will be considered for inclusion in future issues of the magazine. There are, of course, no guarantees of publication and all material sent should be accompanied with return postage.

STONEXUS is more than a magazine. It is also the forerunner of an envisioned book:

THE OLD STONE ROAD

The title is a metaphor for all that man has, through the ages, wrought with this obdurate, primal material; for the traditions of stone work,ì.

This articulate road originated in the remote past. It is more than ten thousand years long. It is our heritage, solid vestiges of which, varied in scale and style, speak of their makers still.

This book will not be a monograph, but a vast and varied compendium of material, a veritable bible of stone craft. It will be assembled, like a fieldstone wall, of elements diverse in character and dissimilar in size and shape. Previously printed pieces will, with permission, be reprinted in their original typescript (as we have done, in this issue of the magazine with the.1899 Manual and the excerpt from Stud Terkel's WORKING)

The weighty volume will be produced by THE STONE FOUNDATION, that is to say, us. I will be, not the writer of the book, but its editor. Combining results of my own research with materials collected and contributed by you, the other members of our “lithological” society, I will build this book.

STONEXUS and THE OLD STONE ROAD are instruments, tools with which to effect the stated mission of THE STONE FOUNDATION which is: to preserve and perpetuate the traditions of the craft of structural stonework . The craft has been overshadowed by the technological developments of the last century and relegated to the periphery of architectural endeavor, but a lost art it is not. Like stone it endures, continuously redeemed by the diligent labor of dedicated craftsmen -and craftswomen.

Tomas Lipps,
Editor

p.s. There is more me in this first issue than might seem seemly. Not only this EDITORIAL, but the PROFILE, and the BEFORE AND AFTER sections and the photos in the GALLERY and elsewhere, even a CARTOON -my apologies. This is not (only) due to vanity. This is because the only examples I could supply of these features, which I envision appearing regularly, were my own. Hopefully, readers will continually provide fresh materia for future issues.

NOTE: Gratitude is due to the Luck Stone Corporation of Virginia, the Cee-Jay Tool Company of Loveland, Colorado, the Colorado Flagstone Company of Masonville, Colorado and Rock and Co., Brighton Colorado whose generous support made the publication of this first issue possible. Your belief in the potential worth of STONEXUS Magazine and your support are both greatly appreciated.

THE STONE FOUNDATION

Those who have visited the Stone Foundation web site, www.stonefoundation.org may know something about the origins and goals of the Stone Foundation, but for the benefit of the many members and members-to-be who are not Internet-savvy, an explanation:

The STONE FOUNDATION came into being in 1986 with a stonemasonry workshop in northern New Mexico. An irresistible pun, the title was used to identify the group of friends and fellow stonemasons who comprised the team of instructors: George Gonzalez from California, Joe Kenlan from North Carolina, Tomas Lipps of New Mexico and Toru Oba from Virginia. Sixteen novices were introduced to the craft during the course of a two week "apprenticeship". Worthy projects , dry stone retaining walls and a spring house, were accomplished. As well as basic skills on which to build, the novices gained an understanding of the fundamentals and an appreciation of some of the finer points of structural stone work.

Five workshops followed over a ten year period - in New Mexico, California, North Carolina and Mallorca, Spain. The success of these workshops and the camaraderie experienced by the participants led to the concept of a symposium of stonemasons.

There is an entity known as ABANA, the Artist/Blacksmith Association of North America. It was launched at a symposium of metalworkers - artisans and sculptors - which took place at Fire Mountain, GA in 1976. Subsequently it has evolved into an international organization with a membership of more than 4,500 and a quarterly publication, T he Anvil's Ring which serves to connect and inform those involved with metal work.

Obviously something similar would benefit the craft of stone work and its adherents. An event was envisioned during which fellow stone masons (and others in related fields) from all over the country will have the opportunity to meet, to socialize and to discuss the craft; an event that would engender a structured, nation-wide organization [with international associations] which will serve to connect and inform an extensive membership - the modern version of a medieval craft guild with a periodical publication, a directory of professional practitioners, educational resources, an on-line forum, information clearing-house, and book shop, subsequent gatherings and eventually, perhaps, a physical center.

This vision remained a vision for years until late in 1999 when, energized perhaps by the contemporaneous millennial zeal, the initiat ive was finally taken to realize it.

STONE WORK SYMPOSIUM 2000 was planned and publicized and took place in November last year. More than seventy enthusiastic practitioners, advocates and aficionados of the craft convened and communed in Santa Fe New Mexico and THE STONE FOUNDATION was launched.

Now (in July 2001) THE STONE FOUNDATION numbers 130+ members in 23 states and 6 countries -a long way from 4,500, but a good start. The core membership are stonemasons but anyone involved with or interested in stone, stonework and stone art is invited to join our society. And we ARE a society, a wide spread community unified by our mutual interest in stone and the articulation of it.

THE STONE FOUNDATION is a registered corporation in the state of New Mexico. Its products are Education, Information and Communication. Non-profit, 501(c3), status has been applied for.

Tomas Lipps,

Founder/Director

In There Somewhere

written and illustrated by David Griffiths.

the DSWA, the Dry Stone Walling Association of Great Britain in 1999

Roadside wall with stoup

This is not going to be an objective review; I have a particular fondness for this little book that began on page 3 with the definition of a dry stone wall: "A wall built from unmortared stones, held together by itself ."

David is an artist, a graphic artist. The book is chock full of his fine pen and ink drawings which reveal a knowledge of the principles of the craft available only to someone who has been involved in it. This involvement which, as many who read this know can be obsessive, began for David with the patching of a garden wall to keep his children in and cattle out. In that experience a passionate interest in stone construction, particularly the dry stone walling aspect of it was born, an interest which lead to years of experience, research and, finally, this book.

It was the person of Steven Allen, an acknowledged modern master of this ancient craft that acted as a catalyst for the book David wanted to write. Steven's life and work is the means by which attention is focused on the traditions and present day status of dry stone walling. "For me, Stephen is one of the finest exponents of the craft of dry stone walling of his generation ... he allowed me to watch and work with him on an extraordinary range of walling projects, and it was during the hundrdeds of hours we spent together that I was able to glean his technical, experiential and sometimes philosophical views about walls and walling."

Another person "In There Somewhere" is Andy Goldsworthy, the well known artist who has utilized the talents of Steven and other dry stone wallers in his remarkable installations in England as well as in this country. The relationship of artist and artisan in these projects is explored.

A considerable part of the book is concerned with the dry stone walling competitions which are popular in Great Britain. It is at one of these that Steven Allen comes to David's attention. David also candidly describes his own participation in one of these events and finally outlines the procedural sequence of a DSWA "Grand Prix" competition.

Although this is not an instructional manual, there is much a novice or even an experienced professional mason can learn from it. In the tracing of Steven's evolution many elemental practices of the craft are elucidated and a section in the latter part of the book a chapter describing dry stone walling features with which a certified DSWA Master Craftsman is expected to be proficient was particularly instructive.

If the book has a fault it is that it is so small. Some sections were all too brief. The chapter on walling styles in different areas of Great Britain was disappointingly sketchy; it left me hungry for more. Perhaps, David, that might be the subject for a future book?

Tomas Lipps

IN THERE SOMEWHERE was published by the
Dry Stone Walling Association of Great Britain
c/o YCF Centre, National Agriculture Centre
Stonleigh Park, Warwickshire, CV8 2LG
England (www.dswa.org.uk)

David Griffith's drawings have been used to illustrate the article SOMEONE THERE IS WHO LOVES A WALL by Michael Finkel in this issue. Steven Allen and dry stone walling competitions are also the focus of this piece.

NAVAJO PUEBLITOS OF THE DINETAH

Stephen L. Fosberg

New Mexico Bureau of Land Management State Archeologist

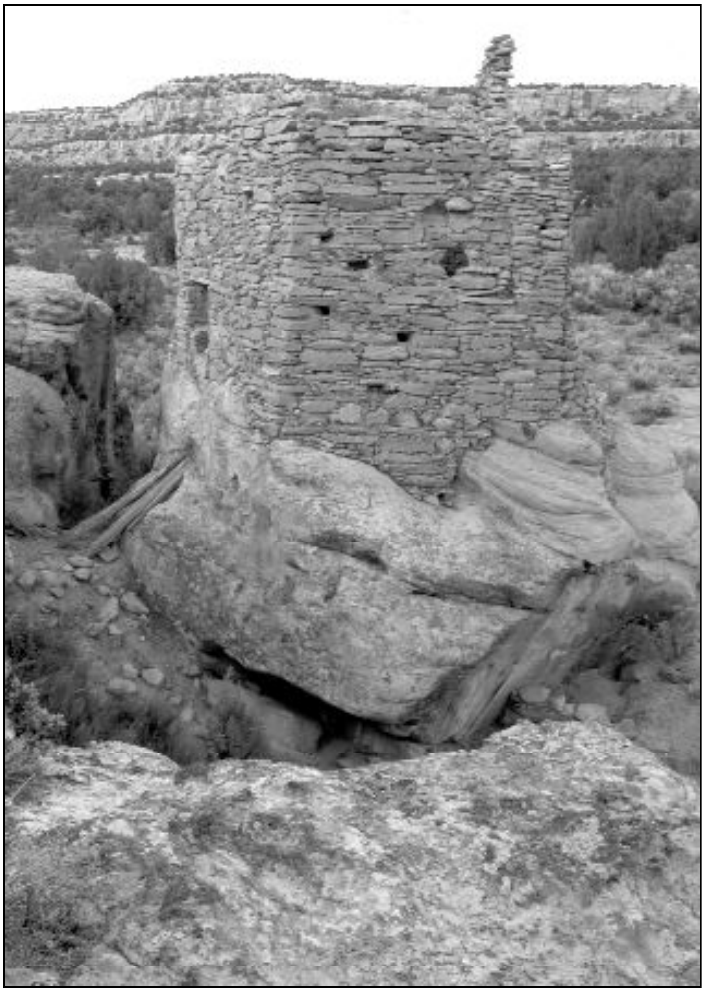
Navajo refugee sites, or pueblitos, are a unique archeological phenomena, centered in the northwest quarter of New Mexico. This region encompasses the mesas and entrenched canyons of La Jara, Gobernador, and Largo and is referred to by the Navajo as the Dinetah. It is here that the Navajo creation story is focused and the geography and place names of the Dinetah reflect its role in both the creation story and clan migration legends of the Dine people.

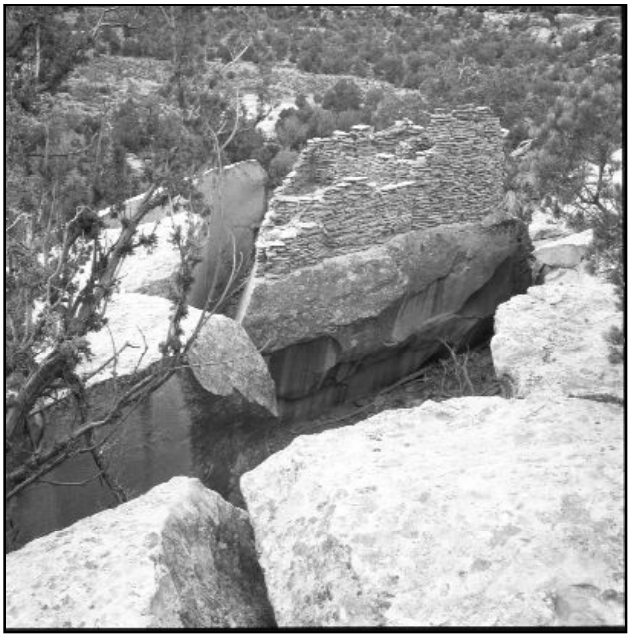
Navajo and Pueblo Indians first encountered one another sometime after A.D. 1500. Although periodic Navajo raids against the Pueblos were carried out, the Navajo-Pueblo relationship was generally one of trade. As a result of these periodic contacts, Pueblo influence is evident in 18th century Navajo ceramics, rock art, and architecture. Most notable and enigmatic is the Puebloan architectural influence seen in the multi-roomed masonry dwellings referred to as pueblitos.

The majority of Navajo pueblitos were occupied during the Gobernador phaseñat time of social disruption, turmoil, and hostility beginning soon after the Pueblo Revolt in 1680 and ending about 100 years later. Construction of pueblitos increased dramatically after 1700 and the occupation peaked between 1715 and 1735, probably in response to Ute attacks that threatened the survival of the Navajo and Pueblo people in the Largo-Gobernador areas after 1715.

The pueblitos were built on mesa tops, cliff faces, and large boulders and were obviously positioned for defense. Most pueblitos also have expansive views to the surrounding territory and have line-of-sight to other pueblitos nearby. In addition to topographic and visual defense, architectural elements often contributed to the defensive nature of the pueblitos.

Small observation ports, called loopholes, were almost always angled downward for visual sightings along access routes into the pueblitos and presumably for shooting projectiles down onto unwanted visitors. Although the pueblitos were often surrounded by steep-sided cliffs or embankments, points of access from below were blocked by masonry walls or log roofs over crevices. Entryways were secured by using dead end ëentries,í serpentine passages, narrowed entrances, single points of access to room complexes, and removable logs for bridges and ladders.

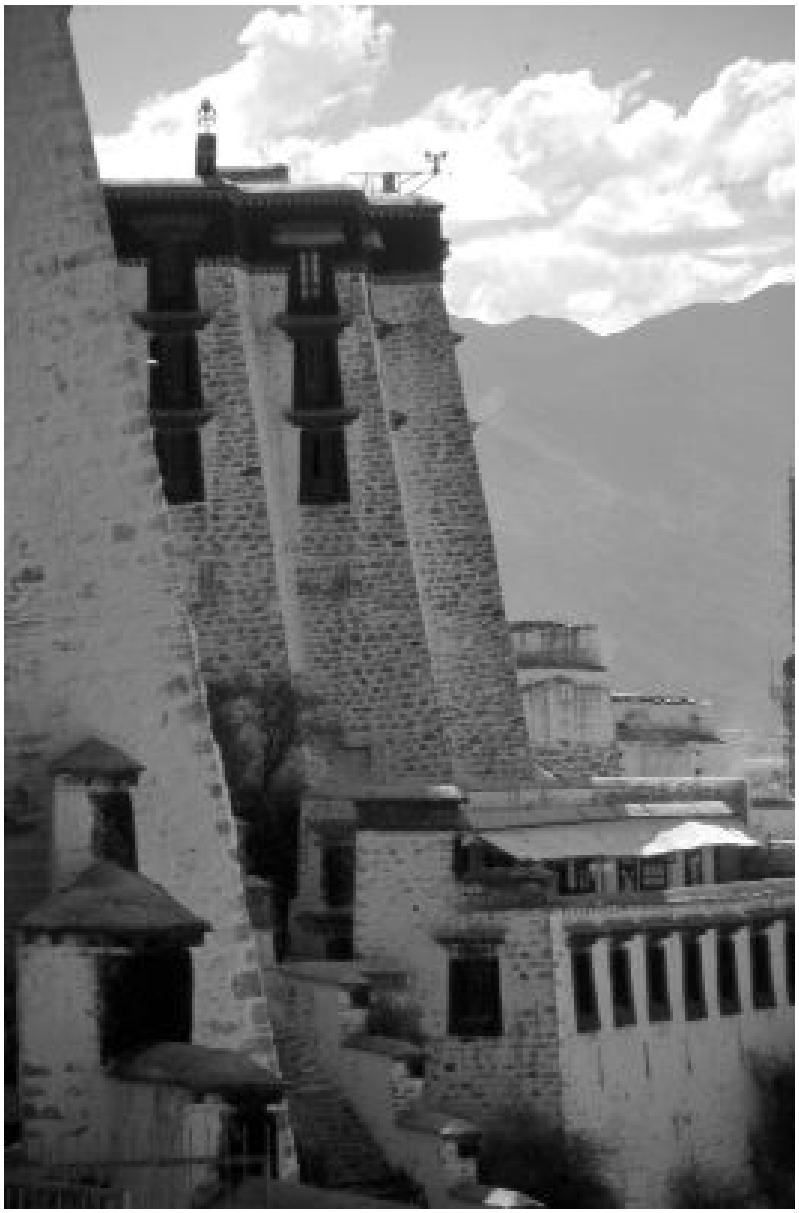




The size of the pueblitos varies from single rooms to large multi-storied buildings up to 38 rooms in size. Many of the sites still have standing walls and intact roofs. Recent comprehensive inventories of lands surrounding the pueblitos documented a multitude of features associated with the pueblitos. It has become apparent that these structures were used as a fortified places of refuge which provided safe havens for only a few days at a time. Pueblitos are invariably surrounded by actual habitation areas which include forked stick hogans, ramadas, corrals, sweat lodges, and work areas.

Increasing influence from Spanish missionaries, the constant pressure of Ute raids, and a possible drought in the late 1770s brought an end to this period of Navajo history. The pueblitos of the Dinetah region were gradually abandoned as the Navajo shifted to the south and west. Left behind were some of the most dramatic and remarkably well preserved masonry structures in the entire Southwest.

All photographs by New Mexico Bureau of Land Management Personnel



The Potala, seat of religious and political power of old Tibet

TIBETAN STONE JOURNEY

Jim Underwood

Most visitors to Tibet enter through the capitol city Lhasa and on their journey from the airport are treated to the range of building methods common through the region: the same adobe block of our American southwest, the rammed earth that is becoming more common in the US, and finally the extensive use of stone in the city itself. Most people don't notice the extensive quarries as they cross the edge of Lhasa Valley; and most leave with the impression that in this land of the earth's highest mountains stone (and, increasingly, concrete) is the dominant building material. My work in Tibet is entirely with rammed earth structures; but my love is for the stonework, particularly the work done more than 50 years ago.

The stonework of Lhasa and a scattering of Buddhist monasteries through Tibet are in fact exceptional in a region where the use of earth for building overwhelmingly dominates; but the monasteries and old Lhasa structures are readily accessible and beautiful exceptions. The monasteries were often built with rock because historically they enjoyed wealth and a vast social support system to haul rock - and they were often built in rockier, less accessible sites. Lhasa had these wealth and social support factors in abundance, along with a readily available source of fine grained gray granite surrounding half the Valley.

High quality dry-stone work was also used in buttressing roads and building bridges in the river gorges and lesser quality work was (and still is) used to terrace fields. With easier transport of rock these days, houses and enclosing walls are often built of rock laid carelessly or well a foot or so up, and then rammed earth or adobe is used above.

Historical & Social Context

There seem to have been two early phases of stone work in Tibet determined by what rock was readily available and what tools were on hand to shape it. The early phases show great similarity with each other; the current, or modern phase is a dramatic departure from the early work.

Very old buildings in Lhasa show the extensive use of un-quarried stone, picked up from streams, gulleys and hillsides, and usually sorted more or less for size and flat face before use. However, the rocks you see on the face of an early wall are quite variable in size and shape; there is extensive use of small, flat chinking stones that create a pattern common across Tibet but especially in Lhasa - larger rock framed in a matrix of small chinking stone. Two and three story walls

are common especially in the old monasteries with the exterior walls thickly built at the base and sloping strongly inward to the top. These walls were laid up with mud mortar in the beautiful horizontal chinked pattern on the outside and inside faces, and random rubble rock was used between, again with a packing of mud mortar. This construction can be seen clearly in ruins. The use of non-uniform stone can be dated reliably in one sacred building (the base of the Jokhang Monastery) to about the 7th century AD, where it is difficult to photograph because of the extensive layering of whitewash. A nearby monastery, Shideh, now in ruins, shows the same stonework in the extensive first story and is easily photographed. The stone work immediately above the first level shows the complimentary but distinctly different, later second phase work.

In Lhasa Valley, a growing national religious / economic/political center, the easy supply of loose stone must have soon been used up. What I refer to as Phase two stonework is much more even in appearance, using stone that appears to have been roughly squared to a general size - stone broken out of boulders as I was watching done recently. The main stones of a phase two wall are distinctly square or rectilinear, laid in long horizontal lines that may run 50 meters in an unbroken back wall. The small flat chinking stones familiar in phase one work remain a clear and distinctive feature of this later work. I have not yet been able to date the transition from one approach to the other except that Phase two was in use by the 1600's; but the lack of intermediate stonework between the two phases indicates a sudden change. This probably happened in conjunction with the introduction of iron tools along the vast continental trade routes many centuries ago. Remote as it was Tibet was an ancient continental crossroads for trade.

All traditional stone work, both in buildings and enclosure walls, was capped with an eaves of slate sloping outward, weighted with a domed ridge of small stone or gravel

Walls of Tayepa Monastery, one of the oldest in Tibet

down the center, and the whole covered with a special crushed soft rock which was tamped into place in the manner of rammed earth. The affect was to shed water from the core of the wall and lend unusual beauty to it.

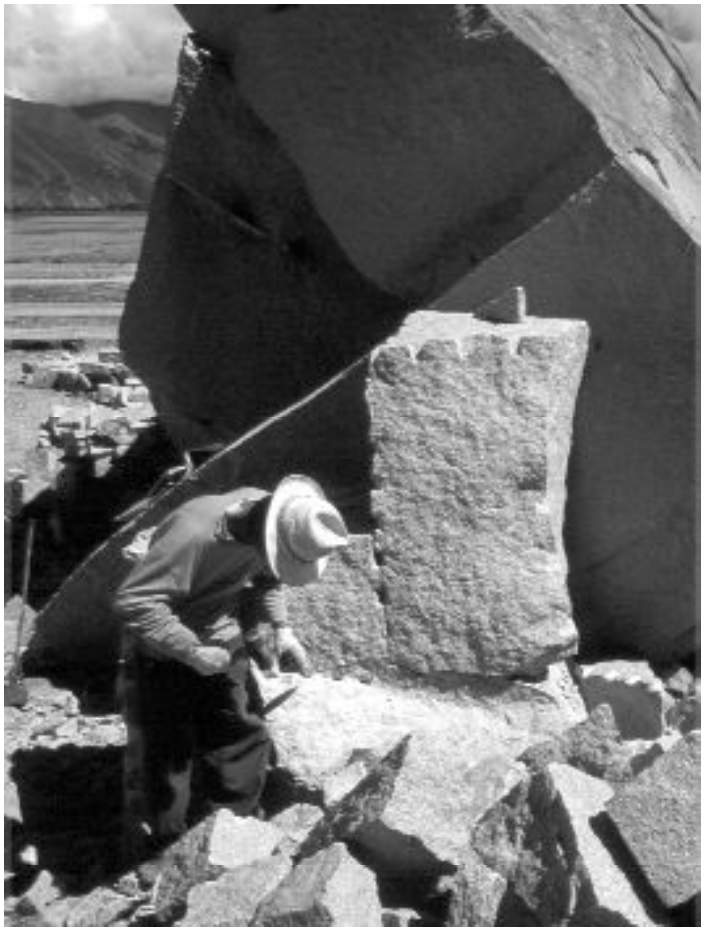
With two exceptions (noted under Potala and Rural) I have not observed many examples of these first two 'classical' phases of stone work being done in Tibet today. I keep looking and hoping; but much as in our own country, technology pushes out handwork until there is enough surplus capital to underwrite a resurgence. The current era represents a nearly complete break from the past, especially in Lhasa Valley

Stonework in the modern era (since the 1950's) employs carbide tipped hand tools which give us well dressed, often carefully finished grey granite in many shapes - blocks, steps, rounds, railings, detailed statuary and so forth. Hand tools have not just been the norm in Tibet, they have been nearly universal in stonework in the current era until very recently. In all my early 1990's visits to quarries, finishing yards and building sites around Lhasa, nearly all work was being done with hand tools with the exception of transport by shofu, the ubiquitous two wheeled Asian diesel tractor pulling a wagon. Most quarrying was done as small hillside operations much like early New England quarrying. During the 1990's, with the dramatic expansion of Lhasa, the demand for building stone fostered the large scale introduction of industrial quarrying on the north and northeast flanks of the valley. Nearly every day you can hear the sound of dynamite breaking up the faces.

The new hotels of Lhasa sport polished slabs of marble, pink granite and other rock in the lobbies, but these typically have all been manufactured in mainland China and shipped in at great expense. Now we are starting to see extensive stone working yards with large diamond saws cutting the local grey granite into thin slabs which are ground to not-quite a polish. This is stone veneering, not really artistic stone work; and while the granite used for

wall building these days is highly worked and mortar laid, the hand quarries are interesting.

Given Tibetan wage labor rates vs the cost of power production tools, the hand tools will likely persist and perhaps dominate for some time. A good hand craftsman can be hired for about $3/day and rough quarry folks, though often paid at piecework rates, cost less. Power tools are special order items and usually of very poor quality, prone to frequent breakdown according to the construction company owners I interviewed. People keep on producing, even if at a slow rate.



The Hand Worked Quarries

The Himalayan Range is almost all sedimentary with limestone, sandstone, shale and lots of fossils in with some associated metamorphic rock. The steep igneous ridges of granite surrounding the east, north and west sides of Lhasa Valley (a river defines the south side of the city) are a bit unusual in the region. The quarries and associated stone camps lie about 5 to 20 Km out from Lhasa's center at the bases of all these ridges and many are readily seen from the main roads servicing the city. The individual quarries are shallow cuts into the steep granite faces that often blend one into the next to form continuous white scars at the base of dun colored natural rock.

Hand quarrying works in response to natural fractures and seams in the rock, as you'd expect. The modern difference is that since the easy and obvious seams have long since been worked, the quarrymen have to work seams higher on the granite faces with the consequent dangers involved. Quarrymen climb on pegs driven into holes drilled into the rock faces by hand; at some chosen point they hand drill a series of holes which are then feather and wedged to split out a rock section which will be worked up below where it lands. The industrial quarrying on the valley's north side blasts out large sections into random rubble piles below, end loaders sort it out a bit, and the quarry workers scramble over the debris trying to make sense of it with hand and light power tools. OSHA doesn't exist in Tibet.

Quarry produce is mainly rough rectangular block of standard sizes, larger block for special carving purposes, and debris used for road work, foundations and fill. I have not seen rock dressed at a quarry, though it may be in some cases. Rock transport historically was certainly by yak or on somebody's back, as it is today around the work site. Wheeled carts powered formerly by humans and animals, now by the shofu, dominate transport from quarry to construction site; trucks are increasingly used.

Tibetans traditionally avoid mining as a religiously unsuitable activity and large scale quarrying seems to come a bit close to that. In any case, nearly all quarrying and finishing is done by immigrants from Sechuan, basically the gateway province to the east and the source of most of the immigrant workforce in Tibet. This workforce brings skills and tools unknown to the Tibetans and there is little mixing or sharing. Some ethnic Tibetan construction firms have sprung up and there are a few that are increasingly capable in working stone. Keep in mind that most of Tibet does not build with stone, but with earth.

Dressing Stone

Stone was carved and dressed in Tibet in the per-modern times (before about 1950) primarily for monastery steps, some statuary such as stone lions, at alters and a few support pillars at entrances. Dressing stone was not common until the widespread introduction of carbide tipped tools, primarily with the immigrant workers mentioned earlier. By the 1990's the local Lhasa granite was being worked into all manner of objects - railing assemblies, bird baths on pedestals, round tables with barrel seats, and of course more stone lions - all by hand, a chip at a time mainly at special yards.

The most common output, however, was (and still is) carefully dressed building stone used in the rebuilding and growth of Lhasa. Rough quarry stock of a general size is

delivered to building sites where squared blocks are made to the mason's size instructions. The blocks are faced five sides, excluding the inward face, and laid in concrete mortar (there is only one version of cement common in Tibet). Debris is used for chink and fill on the inside surfaces, which are usually plastered to cover the rough work. Excess debris may be used as fill, in concrete, or sold. For me these buildings are not nearly up to the aesthetic standard of the early stone work in Tibet, but they are good looking and beat the concrete and tile favored by central planners. Some argue that they are stronger and they probably are; but the old structures held fine for many centuries - 14 centuries so far in the case of the Jokhang.

The Potala

The Potala is an overwhelming presence floating perhaps 500 feet above all Lhasa, a huge monastic castle built on a rock island in the valley center. Historically it represented the overwhelming religious and political center of Tibetan Buddhism. From a mason's viewpoint it is one of the larger stone structures in the world, and it presents some exceptions to the building characteristics I noted above for phases one and two stonework.

The main structure is surrounded on the valley floor by a high wall (about 30 feet high) which is rammed earth on the inside (suggesting that earth is the main component of the wall) and faced with fresh granite on the outside. This facing granite was quarried and roughly dressed to size and then laid up according to phase two pattern - sized for height but not so much for length and chinked with small, flat flakes of the same granite. Everything was laid up in concrete and very sloppily struck and pointed, indicating all in all a fairly recent and poorly done repair job. This high wall intersects a main entrance building and "guard" buildings at the corners, all nice two story Phase one work in contrast to the wall.

The main Potala building was built in stages from the 1600's onward of squared stone throughout (excepting Phase one in the walls enclosing the massive staircases), giving us some indication that Phase two capability was in place by then. During the 1998/99 restoration work the chief architect took me into the eastern bowels of the Potala to where the main rampart walls join the bedrock of the hill. Looking out the vertical ventilating slits you could see a dozen feet of laid rock, and inside was a catacomb of pillars supporting the many floors and walls above. I later heard that all the base rock of the Potala was set in molten lead, but I have not been able to confirm this.

Rural Work

There are perhaps a half dozen areas of Tibet where rock and some level of population density combine; and then there are quite a few sparsely populated areas where rock is used extensively ñ mainly at the southern edge along the Himalayan backbone and in river gorges. Increasingly, also, rock is trucked to places where it was never used traditionally.

The rural work is a hodge-podge of quality, from recent thrown-up terrace and enclosure walls which collapse frequently to some very nice old road buttressing and arch bridge work along the steep gorge walls (modern road work utilizes a lot of stone, all concrete laid). Here and there an old well-laid wall appears, usually in ruin. The main difference in the well-laid old rural walls from those of Lhasa Valley is in the chinking, which is done randomly without so much emphasis on the little horizontal flat stones.

Mentioned at the beginning, currently built quality walls of any kind (building or enclosure) are started with rock as the foundation, the rock going above ground a foot or more. The remaining wall is either adobe or rammed earth (un-stabilized, rammed in forms); the rock prevents moisture from wicking upward and destroying the earthen parts. The rock foundations are sometimes well laid and frequently are not; but at least some sense of quality dry stone work does remain in Tibet.

Tourists will come. Tourism in Tibet, as it is in most places, is both a blessing and a curse. Tourists change the culture they come to enjoy by sparking a vast support infrastructure and a change in local attitudes and aspirations. More positively tourists to Tibet have shown their huge interest in the traditional culture and consequently their support for rehabilitation of the monasteries and traditional culture. The various crafts, including decent stone work, stand to benefit.

Jim Underwood started climbing rocks in his teens and has loved them ever since; he takes on special construction projects in eastern West Virginia and works in small business development (rural construction sector) abroad, mostly Tibet at the moment.

The Wrong Stone

the english houses of parliament - a lesson from history

Scott Engering

Stone buildings have always taken pride of place in the architectural heritage of Britain, none more so than the Palace of Westminster, built between 1840 and 1860, when the British Empire was at the height of its wealth and power.

The elaborately carved facades of the Houses of Parliament, as this building is better known, can hardly fail to impress a visitor to London but, behind this expression of grandeur which is presented to the world, there is another story to be told; one that is relevant to architects, stonemasons and geologists concerned with the selection and use of building stone today.

After the destruction of the old parliamentary buildings by fire in 1834, a national competition was held to design a new set of buildings, with the only proviso being that these should be in the Elizabethan or Gothic style. The eminent architect Sir Charles Barry emerged as the winner from 97 entries and one of his first tasks was to locate a suitable building stone which would satisfy the combined criteria of durability and relative ease of working.

For these reasons, Portland stone, a hard oolitic limestone from Dorset on the south coast, had already acquired a reputation in the capital, where it had been widely used in churches and other buildings over a hundred years old and the London Guild of Stonemasons advocated that Portland stone be used for the new Houses of Parliament. However, in response to new scientific evidence suggesting that limestones might not be resistant to the increasingly sulphurous London atmosphere, it was considered appropriate to investigate a full range of alternatives, together with an assessment of their relative costs.

A Select Committee comprising the architect, Sir Charles Barry, a leading mason/sculptor and two eminent geologists of the day, was duly appointed and a tour of 102 quarries together with an inspection of associated reference buildings followed, complemented by a series of laboratory tests. The final shortlist comprised Portland stone, the renowned Darley Dale stone (a hard, medium grained Carboniferous sandstone) and three dolomitic limestones of uncertain pedigree.

One of the primary considerations appeared to be the selection of a material that was crystalline and possessed a chemical composition near to that of the mineral dolomite, a calcium-magnesium carbonate. Scientific analyses had shown that dolomite was very resistant to the effects of dilute acid and a dense crystalline structure provided minimal surface area upon which chemical agents could act.

Although the scientific or, strictly speaking, chemical reasoning applied at the time still holds true, it seems that the commissioners, despite their professional standing, did not apply their field observation and surveying skills to good effect when finally selecting the dolomitic Bolsover Moor stone.

It was not long after the laying of the foundation stone that it became clear that Bolsover Moor quarry was unable to provide the volume of stone nor blocks of a sufficient size to satisfy the design. Persisting with their faith in modern analytical science, the commissioners turned to the nearby Mansfield Woodhouse quarry, again with the same results and then to Anston in South Yorkshire, from which all the stone was eventually supplied.

All seemed well until, a few years later, the stonework began to crumble at an alarming rate, especially the intricately carved details, and in 1860 Charles Dickens, the astute social observer, felt compelled to describe the material as being “the worst ever used in the capital”, having seen the need for constant, expensive repair.

Whilst in hindsight it easy to criticise, the commissioners themselves pronounced that “buildings which are highly decorated afford a more severe test of durability of any given stone”, a consequence of the increased surface area presented to the elements and, heeding their own advice, a much closer investigation of the in situ physical characteristics of the dolomitic limestones would have revealed the following.

Sections through many of the quarried and natural exposures of the dolomitic limestones in Derbyshire and South Yorkshire display sequences of massive, horizontal and laterally persistent beds up to 900mm or more thick. It is

undoubtedly these that provide the best building stone. However, this is the exception and not the rule. Overall, the impression is one of rock faces that are disrupted, often at oblique angles, by joints and fissures and with extreme brecciation of the thinner beds.

Apart from these obvious faults which limit the block size available, a close examination with the naked eye or hand lens reveals that much of the stone contains small crystal lined cavities, is often minutely cellular and on weathered surfaces, randomly orientated calcite veins stand proud. To the architect, quarryman or mason, these details may, understandably, be overlooked but to the geologist these provide clues which indicate that an apparently sound block of stone contains minute cracks and voids which will open up and fail when fully exposed to the weather.

Walking around the pristine exterior of the building today, there is little evidence to suggest that approximately 50% of the visible masonry has been replaced during the last 130 years but, hidden from public view and cameras, the stonework of the inner courtyards is still severely blackened. Here, despite a sheltered position, many of the plain ashlar blocks, simple mouldings and string courses, that have failed without obvious reason, are preserved in an advanced state of decay.

Numerous ancient buildings constructed from similar dolomitic limestone survive in good condition today but, almost without exception, their masonry is very plain and functional. Selection of poor quality material at the quarry face was largely blamed for the decay at the Houses of Parliament. With the sheer volume of material supplied, the apparent lack of professional supervision at the quarry and the quirks of human nature, where price work and profit is concerned, there is no doubt an element of truth to this argument. It is, however, very difficult to escape the notion that the commissioners chose not to rely on much of the evidence presented before their own eyes, from both buildings and the quarries themselves.

The Anston quarry ceased production in 1913 but one can still see the occasional face, complete with evidence of inherent structural defects, where stone was once extracted using the traditional method of plug and feathers.

As for the Houses of Parliament itself, Clipsham stone has been used for repairs since the second world war and, given that it is an oolitic and shelly limestone with a totally different composition, it blends in remarkably well. For building purposes, dolomitic limestone has been virtually consigned to history, with only a handful of quarries supplying small amounts of material for restoration and for vernacular walling stone.

© Scott Engering is an English geologist and building stone consultant

Stone Foundation Home Page

STONE WORK SYMPOSIUM 2000

cornterstone of new foundation laid

In early November more than 70 stone masons and others in related fields gathered in Santa Fe, NM to participate in the first national symposium devoted to the craft of structural stonework.

The stated objectives of the event, knowledgeable discourse, professional camaraderie and the launching of a nationwide association of stone masons and others in related fields were all manifestly achieved. The attendees, young and old, men and women, responded enthusiastically to the opportunity to socialize and discuss the craft with others who shared their interest. Many of these discussions were stimulated by a series of remarkable presentations by experts in various areas of stone work.

In order of appearance, the speakers were:

CHARLES "MAC" MCRAVEN of Charlottesville VA, stone mason, restoration specialist and author.

TIMOTHY SMITH, a stone mason and instructor of stone mason apprentices at the Cathedral of St. John the Divine in New York City.

VINCE LEE, Colorado architect and expert on the massive masonry of the Inka who appeared in the NOVA series, "Secrets of Lost Empires".

PATRICK MCAFEE, a traditional Irish stone mason and author. Patrick, who presented a survey of the stone work of Ireland, also gave a demonstration of the preparation and use of traditional lime putty mortar.

Patrick Plunkett demonstrates stone cutting techniques.

PATRICK J. PLUNKETT, an English stone mason who has worked at Portland and Salisbury Cathedrals in England and the National Cathedral and the White house in Washington, DC. Patrick also gave a demonstration of stonecutting techniques.

JOHN MAINE, an internationally known English stone sculptor whose public art projects are based on the principles of stone masonry.

MARIO MACHNICKI, Polish stone mason and restoration specialist. A representative of the U.S. Heritage Group, a consultant team of traditional masons, architects and conservators.

JANE WOOLEY, a representative of the Kentucky-based Dry Stone Conservancy, a group dedicated to the preservation of dry laid stone walls and traditional walling techniques.

and TOMAS LIPPS, of Santa Fe, stone mason, designer and director of the Stone Foundation. Affairs commenced with a convivial, informal gathering in the bar and lobby of a Santa Fe hotel the evening before registration and the scheduled sessions began... and culminated at a convivial "last supper" at a local restaurant.

The venue for the Symposium was a small but spacious theater near the center of town. On the afternoon of the second day, however, the assembly traveled north of Santa Fe to a stone yard and workshop where the demonstrations of stone cutting techniques and lime putty mortar took place. The enthusiasm with which the attendees responded to an opportunity to handle stones and tools recom-

mended that subsequent symposiums include hands-on sessions when masons, and others, will be able to work together. On the fourth and final day an excursion was planned to the Anasazi Indian ruins at Chaco Canyon in western New Mexico, but the first snow storm of winter, a heavy one, necessitated a schedule change. The group took over the back room of a local cafe and spent the day spent the day in friendly, informal conversation about stone building and related topics.

In addition to the lively discussions stimulated by the presentations a significant portion of the Symposium was occupied with determining the function, the form, and the future of the Stone Foundation. It was enthusiastically agreed that the Symposium should be an annual event. Tomas Lipps of Santa Fe, who conceived of and organized the event, was affirmed as the director of the Stone Foundation. A planning committee will work with him to determine the organization's mission, structure and activities. Non-profit status will be acquired. The association will be organized into regional "chapters". And the entire membership will serve as an unofficial advisory board, offering comments and suggestions to the planning board and director.

The principal mission of the Stone Foundation will continue to be the preservation and perpetuation of the traditions of the craft of structural stone work. It will strive to foster awareness of and appreciation for good stone work among those who might employ stone masons - architects, designers, contractors, and clients - as well as among stone masons themselves. Symposium attendees were agreed on the need, not to impose standards, but to define them and make them available.

The Stone Foundation will serve to connect and inform stone masons and others in related fields by means of the stonexus magazine and events such as the Symposium. And it will nurture the network that has already begun to form; the network of which it is a nexus. As it is a more inclusive term, STONEWORK SYMPOSIUM was a more appropriate one than STONE MASONRY SYMPOSIIUM to describe this event. Most of the attendees were stone masons -but not all. They were joined by a significant number of stone suppliers, quarriers and sculptors, of contractors, architects and landscapers, conservators and aficionados; all of who, in diverse ways, participate in this archetypal activity.

The Symposium was energized by this diversity of involvement within a shared area of interest as, hopefully, the Stone Foundation will be.

Photographs by Bill Braswell.

Joe Kenlan Patrick McAfee George Gonzalez Tomas Lipps Toru Oba

DRY STONE WALLING IN SWITZERLAND

Gerhard Stoll

Switzerland is a country with an extremely varying topography. From flat plains to the steepest slopes diverse types of landscape exist; regions in which diverse historical types of dry stone structures can be found. There are the well known stone terraced slopes for the cultivation of wine (and in times past for potatoes and cereals as well) in the southern Swiss regions of Graubünden, Tessin and Wallis. There are extensive free standing walls which served to confine cattle and to mark boundaries (mainly in the western parts, e.g. the Jura). There are also many mule paths, stables and buildings for living quarters, which were erected using dry stone masonry. Especially interesting are the buildings which served for special purposes such as neveras, dry stone buildings in the form of pits, for the storage of snow and ice to cool products throughout the summer and the crots, huts with corbeled vaults, similar to the Apulian trullis of Western Italy, which served as locations for the processing and storage of milk, cheese and butter.

Old vineyard
New dry stone wall.
A project executed with the
civil service in the valley of Schenkenberg.

Detail of Schenkenberg vineyard wall. The new wall was built behind the old and a staircase was created.

The wide-spread distribution of dry stone structures in the mountainous parts of Switzerland reminds us of the fact that historically Switzerland was not the prospering place of banks and industry we know today, but a poor agricultural country. Expensive materials weren't affordable and transport over long distances was not possible due to a lack of roads. So people fended for themselves by constructing the needed b %uildings with the durable and plentiful material to hand -stone- using what was then a cheap work force drawn from the rural populace.

The last important epoch of dry stone walling in Switzerland was the second half of the 19th century, the era of the industrial revolution. At that time large infrastructural projects across the alps were undertaken: extensive railway lines (including the famous Gotthard Tunnel) and roads were built over the principal passes of the Alps. Massive structures were required to protect these railway lines and roads -and villages- against avalanches. In the course of these constructions dry stone masonry was used on a large scale. Engineered masonry was the first major trend in dry stone construction to evolve from the anonymous "vernacular architecture" describe d above. Its development was effected by the French army corps of engineers which established a new theoretical basis to the traditional way of building during the French revolution and the reign of Napoleon.

The situation today:

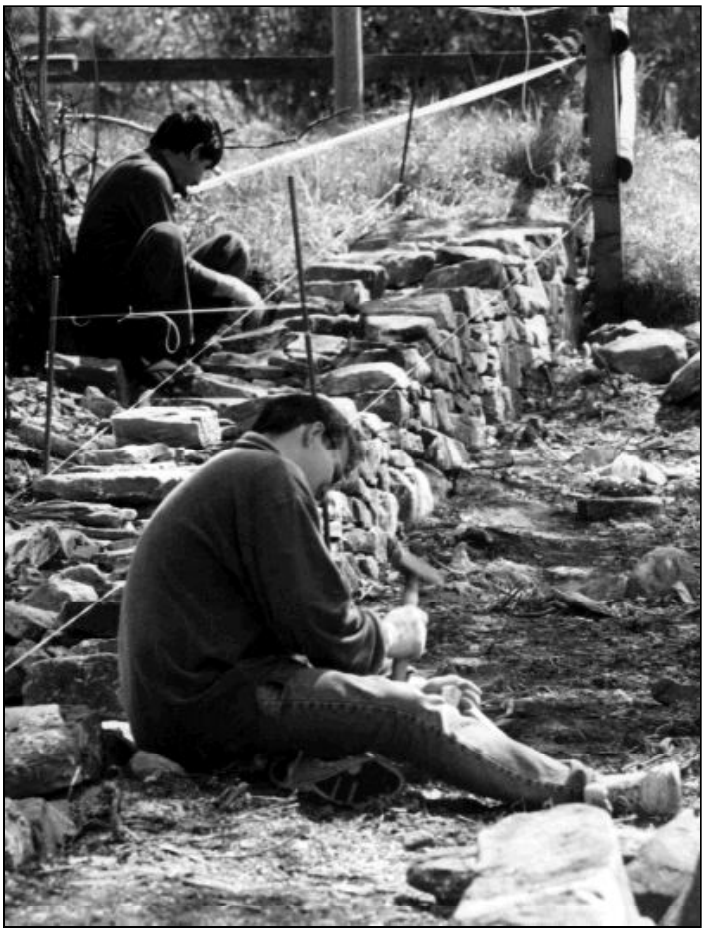
In the last 50 years in Switzerland the know-how of building and repairing dry stone walls has been lost. The reasons for this are the population migration from the countryside to the towns, the mechanization of agriculture and the change from cheap labour costs and expensive materials to cheap materials an jd expensive manpower.

In the last five years, the Swiss Stiftung Umwelt-Einsatz Schweiz or SUS (Foundation for Actions in Favour of the Environment) has successfully reintroduced the techniques of building and repairing dry stone walls. Since its establishment the SUS has, with different groups of participants, built about 9000 square meters of dry stone walls all over Switzerland. These groups consist of volunteers -apprentices, both students and adults, as well as unemployed individuals and conscientious objectors to military service. Organized work camps of these volunteers have constructed extensive new dry stone structures under the guidance of experienced masons.

Stone Foundation Home Page

The mission of the SUS has evolved from the realization that , as well as being a valuable ecological niche for many rare plants and animals, the dry stone masonry walls are a important part of the "landscape formed through man", the "cultural landscape" of Switzerland. As is increasingly acknowledged, the saving of and care for these landscape forms is an important part of a sustainable tourism. Therefore in Switzerland the government grants financial support to activities which have as a goal the preservation of these landscapes. Because of this support dry stone structures have been built and are continuing to be built which would have been inconceivable otherwise.

When the SUS became occupied with dry stone walling, members of the British Dry stone Walling Association came to their assistance by enabling a group of interested Swiss persons to lea rn the techniques. Today a group of seven freelance dry stone masons (one woman, six men), work every year for several months as dry stone wallers. While the SUS only works on projects which lie in the public interest, the seven dry stone masons also execute private commissions. Working in a loosely organized talent pool with the name, "Stone-Line", they have undertaken technically and esthetically challenging projects



Training project at Trimmis with disoccupied people.1998.

The Outlook:

Dry stone walling in Switzerland is at the moment in a phase of vigorous development. As in several of our neighbouring countries there is a concentration on the engineering of dry stone retaining structures and the broadening of knowledge about their ecological functions. Developing and perfecting techniques for such building is a constant concern. Where possible and when needed the work is also aided by machines, small excavators, etc. To handle the weight of the big stones needed for the construction of high walls (3 meters and more) experimental use is made of small cranes with two or three legs which can be easily moved, even in very rough country.

Contacts have been established with dry stone wallers from all over Europe -the Welsh, Scottish and British members of the DSWA, of course, but like-minded people also from Italy, Greece and Austria. Another important connection exists with France. In collaboration with the French Societe Scientifique Internationale Pour L'Etude Pluridisciplinaire de la Pierre Seche, S.P.S. (the International Scientific Society for Interdisciplinarian Studies of Dry Stone Structures) a conference on Dry Stone Walling in the High Mountains is being planned to take place in Switzerland at the end of August 2002 . We hope that all interested persons will participate.

Contacts:
SUS: *http://www.umwelteinsatz.ch*
email: *info@umwelteinsatz.ch*,
Stone-line: *schneider.winter@bluewin.ch*

Gerhard Stoll is a Swiss architect, dry stone waller and Stone Foundation member.

Stone Foundation Home Page

A History of Walling in Britain

Philip Clark

The craft of building with unmortared stone in the British Isles stretches back at least three and a half millennia, to the village of Skara Brae in the Orkneys, Celtic cells, and the Iron Age brochs of northern and western Scotland. It is found in Britain as elsewhere where large quantities of rock and stone outcrop, and especially where trees and hedges do not grow easily, from height or climate. This is why dry stone walls are found above all in northern and western Britain, and often at higher altitudes.

The earliest field walls were built of stones cleared from the fields so that these could be cultivated and stock enclosed. Quarrying rocks for walls came later, but is still ancient. Dating walls is notoriously difficult, and it is often impossible to tell if they have been rebuilt, but it is likely that walls of small fields in Cornwall date back two or even three millennia. Anglo-Saxon and Scandinavian settlement in the north of England led to extension of fields, especially to the open-field system. These communal fields were fenced off, sometimes by walls, both from the water meadows and from the common grazing or "waste". Linton in Wharfedale and Langdale in Westmoreland preserve walls from at least Norman times. Churchyard walls are often extremely ancient, as the site may be identical to that in Norman or even Anglo-Saxon or Celtic times. They may have been rebuilt more than once over the centuries. Fortunately, a number have been recently rebuilt or repaired.

Half a millennium ago, the walling of smaller fields reached a height in the Elizabethan period when cottagers and householders were for the first time legally permitted to enclose small "crofts" or private holdings. The pattern of small Pennine field walls around many villages is from this period. The enclosure movement continued piecemeal during the 16th and 17th centuries as population grew and the open-field system broke down. In a nutshell, most of the field walls you see in Britain have been built from 1500-1900. Those forming very small fields, often higgledy-piggledy around homesteads, are the oldest and were built probably only to retain animals kept in subsistence farming. The small, regular fields were the next period as people began to understand animal husbandry, the need for pasture improvement and clearance of stone, etc.

Walling changed with the large-scale enclosures from about 1780, promoted by landowners or entrepreneurs who could engineer private Acts of Parliament to abolish common rights. The long walls stretching out over the hills were mostly built during this period. Teams of professional wallers appear, hired to build many miles of walls quickly. Exacting specifications survive from this period, and many walls still bear evidence of their origin, with precisely placed throughstones and topstones, uniform batter, and unvarying height. In the Pennines this movement was finished by about 1820; in the Lake District it was mostly of the 19th century. Organised Scottish enclosure walls had begun in the early 1700s, and both in Scotland and in Wales there are many Victorian estate walls, often of high quality.

The "enclosure style" is now the norm, especially since the encouragement of nation-wide standards by the Dry Stone Walling Association. This will mean a width at base of perhaps 32-36 inches, and below the coping stones of 16-18 inches, with a height to there of 4 or 4 1/2 feet. The upright coping stones will add a further foot or 18 inches, and the wall should then be stock-proof. In some parts a regular line along the top of the copes is preferred; in some projecting flagstones or coverbands are used below the copes. A flat top of horizontally laid flagstones is not preferred for walls whose prime purpose is to be stock-proof, but may be seen, for example, on churchyard walls. On the New Red Sandstone and some of the softer Coal Measures gritstones, copes were in the past elaborately trimmed to semi-circles or to triangles. Throughstones should run across the wall at intervals of three feet or so to hold the wall more firmly together; in some areas, of northern England especially, there are one or two continuous rows of throughs. Gritstone throughs were regularly brought to the Craven district of Yorkshire to make up for their lack in the local limestone. A Cotswold or South Wales wall may be narrower for its height to make up for not having big foundations or regular throughstones.

But the style of walls must always reflect the nature of the local stone, as few field walls were built with stone imported into the area. Level-bedded sedimentary rocks, whether in the Cotswolds or in and around the coalfield areas, will make regularly coursed walls, while most igneous or metamorphic rock will make for random or boulder walls and dykes (the Scottish name for walls).

By 1900 there were few areas left to be enclosed or subdivided, although walls dividing the fields from the rough grazing were still being rationalised from the earlier haphazard extensions into the "waste" by rebuilding in continuous stretches. Until the drastic fall in the numbers of labourers on each farm which continued through the 20th century, most walls were built, rebuilt, or just "gapped" by farm workers.

Despite the advantages of walls as stock-proof boundaries, many have been replaced by fencing. This is partly because the local farming may have changed from pastoral to arable, largely because of the time and labour needed to repair them, and recently because of the temptation to farmers to sell the stones for facing new buildings. Walls, unlike hedges, still enjoy no legal protection in the UK, as they do in, say, Switzerland. A recent Countryside Commission report on the Condition of Dry Stone Walls in England found only 4% are in tip-top condition! The

Walling competition. Novice class in foreground, American in middle distance,professional class in distance.

report estimated there were some 112,000 kilometres of dry stone walls in ENGLAND: DSWA believes this is a conservative figure. Grants for repair and rebuilding by government and other agencies have been only sporadically available in recent years. DSWA lobbies Parliament and the new Welsh Assembly and Scottish Parliament on grants and protection for walls, with limited success so far. Many of the National Parks, and the great voluntary agency the National Trust, have been very co-operative in the drive to preserve the walling landscape, as environmental concerns have come to the fore in Britain.

Road widening has swept away some walls, though there have been not a few major new roadside walls, where new highways and bypasses have been built in walling country. Recently there has been a vogue for using dry stone walling in prestigious environmental projects, sometimes associated with post-industrial redevelopment; the best of these are excellent but some are ill-conceived in design and/or badly built by non-specialists. “Instant heritage” could be an unkind name for some of these projects; a problem has been that even when well designed and constructed they are not adequately maintained, particularly in urban environments where they are vulnerable to vandalism.

It's a sad feature of the crisis in British farming that most professional wallers at the moment make most of their income out of these environmental walls, or from garden walls.

History of DSWA

The Dry Stone Walling Association of Great Britain was founded in 1968, and is a democratic organisation run by and for its members, and a registered charity. There are branches in most upland areas of Britain, currently about twenty stretching from the Isle of Skye to the Cotswolds, and active members in other areas such as northern Scotland and south-western England. The national body was formed from an original group founded in Galloway, S. W. Scotland, in the 1930s called the Stewartry of Kirkcudbright Drystane Dyking Committee. DSWA currently has 1200 members of whom 250 are professional wallers & dykers (dykers is the Scottish term for wallers), and about 30 are quarries, National Parks, and other corporate members. So it serves both as a grouping for professional wallers and a way of keeping anyone with an interest in touch with each other and with the professionals. The Millennium year 2000 was celebrated by about twenty groups from across Britain coming together over the May Day public holiday weekend to build ten yard sections of the Millennium Wall in their own styles and with their local rocks at the National Stone Centre in Derbyshire. This is not far from Chatsworth where the Association's active and influential patron, the Duchess of Devonshire, lives.

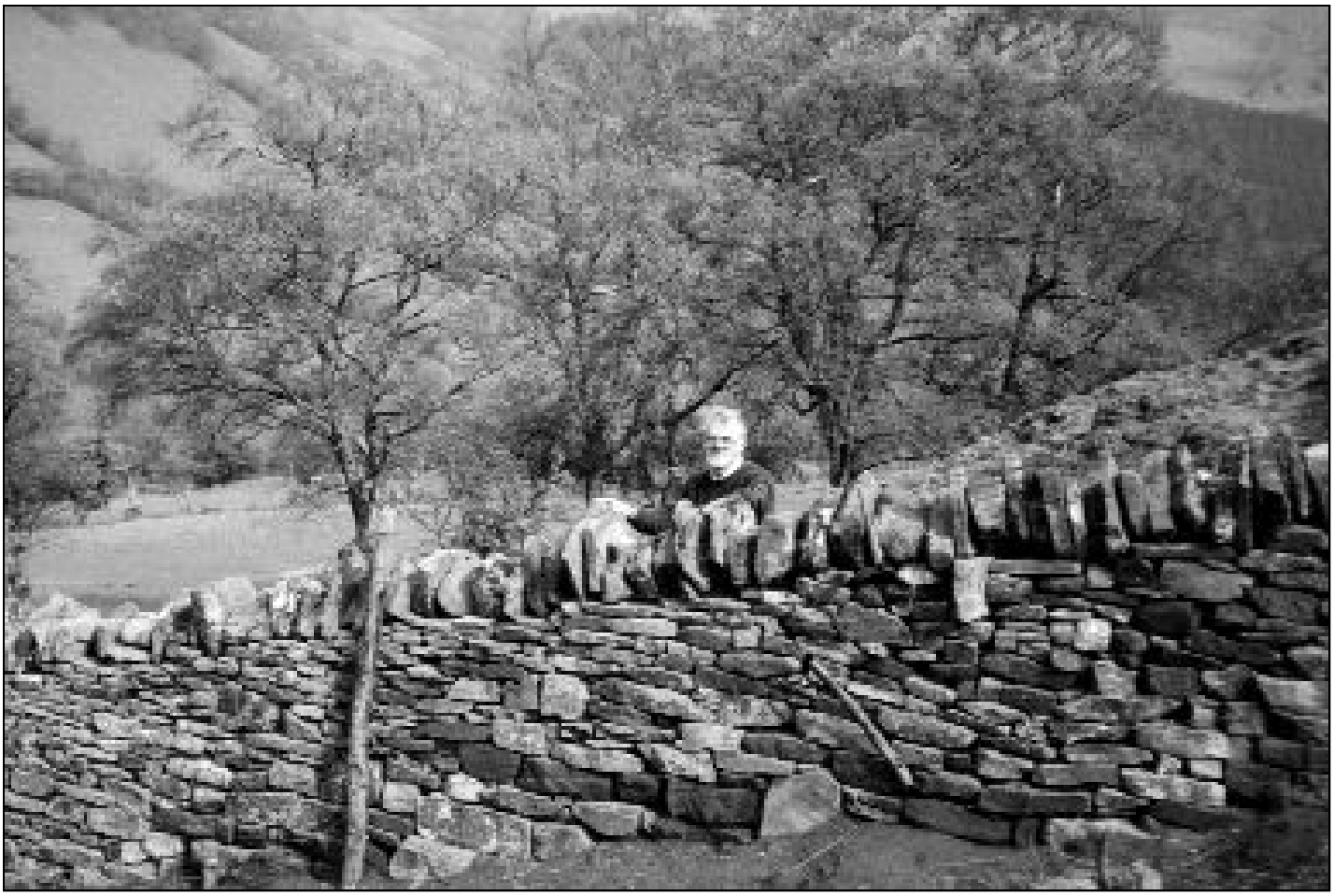
Weekend training wall at a youth hostel

Work of DSWA

The Association works to promote all aspects of the craft of dry stone walling. This includes publication of an annual Register of Certificated Professional Wallers, for DSWA prides itself on its nationally recognised Craftsman Certification Scheme, and has maintenance of standards at the heart of its work. There are too many “cowboy” wallers around, giving the craft a bad name! (I don't know if this word has the pejorative sense in the US that it has in Britain) There are four grades of certification, Initial, Intermediate, Advanced, and Master Craftsman which demands an exceptionally high standard of workmanship and now mastery of the features increasingly called for: arches, pillars etc. DSWA's standards of and commitment to training are recognised by British national bodies such as the Craft Training section of the Countryside Agency.

DSWA also publishes a series of free leaflets, some being technical specifications, including local styles in SW Scotland, Wales, Cornwall, and the Cotswolds.

Another free leaflet is issued annually detailing courses open to the public around the country run by DSWA branches with instructors who are certificated dry stone wallers and (usually) recognised instructors. There is great demand for these courses, both as an "activity weekend”



Completed training wall

with a difference, and because people have some large or small project on their own holding or in their garden involving stone.

Publications include also very popular inexpensive booklets on dry stone walling: Building & Repairing Dry Stone Walls (£1.70), Building Special Features in Dry Stone (£1.70), Better Dry Stone Walling (£1.70) and Creating a Natural Stone Garden (£2) all available by post. There are "special interestî free leaflets: Wildlife and Walls, Bee Boles, Geology for Wallers. All publications are listed in the mail order leaflet.

DSWA has recently run a weekend's introduction to geology in the classroom and in the field for members, in the Yorkshire Dales National Park. This was a welcomed addition to its various existing regular courses for members: business management for professional wallers, instructor training, "standard setting" for examiners. Examiners are needed for the Craftsman Certification Scheme and in the one-day competitions which most branches hold from May to September to find the best competitive wallers from the professional and amateur sectors. For some years a national Grand Prix walling competition was made up of a number of these branch competitions and found a National Champion; at the moment competitions are not so popular and it has been suspended. Demonstrations are given at many local events and at big national events: the Royal Welsh show, the Royal Highland Show, the Natural Stone Show. DSWA operates a Pinnacle Award Scheme for projects encompassing dry stone walling which show exceptional skill and unusual features: few projects have so far been awarded this prestigious accolade. A "certificate of merit" for projects of worth, but less outstanding, has seen a number of awards.

Contact: Dry Stone Walling Association of GB, PO Box 8615, Sutton Coldfield, B75 7HQ; e-mail: j.simkins@dswa.org.uk; International co-ordinator and Deputy Chairman, Philip Clark, 4 Dan-yr-Allt, Llaneglwys, Builth Wells, LD2 3BJ; e-mail: *chipgc@aol.com*

Philip Clark of Llaneglwys, Breconshire, Wales is the Deputy Chairman and International Co-ordinator of the Dry Stone Walling Association of the UK, former professional waller and Stone Foundation member.

THE STONE AGE, STILL WITH US

dry stone masonry in the united states

Carolyn Murray-Wooley

The intrigue of re-discovery

From coast to coast across the country, newly recognized treasures reveal a dry stone heritage richer and more diverse than most people realize. Along the back roads, in areas less impacted by modern highways and new construction, it is thrilling to discover and begin to comprehend the vast use of stone - this most basic building material - in the development of American agriculture, transportation, and industry. Our perception that we are a "new" country is modified when we recognize two to three hundred-year old structures that are still part of our daily lives.

Long before European settlement, native Americans built dry stone and adobe dwellings, kivas, terraces, and aqueducts, that constantly entice study and understanding. Yet in the seventeenth century, colonists forged another American heritage from labor, ingenuity, and sheer necessity, using stone-building skills and techniques they brought from Europe

In large regions of the country, stone walls enclosed every field. Drystone mills and dams lined the streams. Stone dwellings, barns, and bridges were commonplace. Towns contained stone court houses, clerk's offices, banks, shops, inns, and churches. Dry stone structures that facilitated colonial transportation still support daily use: road-cut embankments, retaining walls, culverts, harbor walls, stone stream banks, bridge piers and abutments.

Dry laid granite, double-arched bridge in Hillsboro County, New Hampshire, spanning Beard Brook. Built around 1850 and still in use. Photograph by the Editor

In the colonies

Best known today are the thousands of miles of dry stone walls and fences that entirely altered American landscapes. A survey by the United States Department of Agriculture reported that in 1871 that there were 20,505 miles of stone fences in Connecticut, 14,030 miles in Rhode Island, 32,960 miles in Massachusetts, and 95,364 miles in New York State. Susan Allport extrapolated from these figures that it would have taken 1,000 men working 365 days per year, about 59 years to build the stone walls in Connecticut alone.

Yet, in spite of the labor require-

ments, vast areas of the northeastern colonies became criss-crossed by networks of stone walls that surrounded fields, pastures, cropland, and farmsteads. To improve pasturage and allow cultivation, New England farmers had to clear the land of trees and then painstakingly gather the glacially-deposited stone of every size, "from baseballs to bushel baskets" that littered their land. Some farmers simply dumped these stone loads along their field borders and added to them year by year as freezing cycles and plowing yielded ever more stone. Some communities commissioned carefully-built walls meant to showcase prosperity and craftsmanship, but between these two extremes are the majority of servicible, ordinary, ubiquitous walls that continue to characterize New England (Gardner.)

In other parts of the country that were also originally forested, there is deep topsoil and no fieldstone. Here, to provide stock-proof enclosures for expensively-imported animals, to ensure bloodlines, and to conserve desirable woodlands, landowners obtained building material by digging quarries into creek banks and hillsides. Quarried stone produced durable, high-quality stone fences that covered the landscape in the richer areas of Virginia and Maryland, and the Bluegrass regions of Kentucky and Tennessee.

In regions settled primarily by English, Scots-Irish, and Germans, farms contained not only dry stone walls, dwellings and barns - but slave and servant quarters, stables, spring houses, ice houses, smoke houses, loom houses, root cellars, wells, and cisterns. Dry stone techniques may not be readily apparent in these structures because to weatherproof the walls, joints were usually sealed with lime mortar after construction, and now may be re-pointed with cement (a damaging practice.) Dry stone kilns in these regions burned limestone to make lime powder used for the mortar mix. The preferred wood for kilns was hickory because it made the hottest fires, and hickory trees quickly disappeared from the landscapes surrounding kilns.

Colonial industry developed as dry stone dams harnessed the energy of creeks and rivers to drive grist, paper, and saw mills, in places built as closely together along the waterways as local laws permitted. Specialized stone buildings also included distilleries, warehouses, and iron furnaces. With westward expansion, dry stone continued to be the building material of choice. Scots-Irish carried rock fence construction to Missouri and Arkansas, and Germans built carefully coursed dry stone walls, houses, and barns in the Texas hill country.

BY MID-CENTURY.

The engineering skills that fostered the industrial revolution utilized this fabulous, versatile, abundant material on an even greater scale, employing more manpower, specialized construction equipment, and large-scale buildings for manufacturing. Some dry stone structures from this period represent major engineering feats worthy of World Heritage status.

Massive iron furnaces, built of dry stone, fueled developing American industry. Don Fig of the National Forest Service compiled information on the gigantic Fitchburg Iron Furnace, a National Historic Site, in Estill County, Kentucky. The furnace cost over $360,000 in 1866, the year it was chartered to produce iron for post-Civil War railroad construction. This enormous dry stone furnace, sixty feet tall, was built by Italian masons over a two year period from local stone that was quarried a few miles from the site. A few years ago, a scoundrel who wanted to demolish the furnace and sell the stone, filled the structure with dynamite and set it off, but succeeded only in blowing out the side of a doorway (Fig).

The earliest remaining iron furnace was built two centuries earlier, in 1643 near Flynn, Massachusetts. Demand for iron continued to increase and has never stopped, although new production methods developed after the next two hundred and fifty years. In the meantime, between the late-eighteenth and mid-nineteenth centuries, the industry produced thou-

Kentucky rock fence, built of purpose-quarried coursed limestone

New England stone wall of glacially-rounded granite boulders

sands of iron furnaces, built of stone blocks weighing many tons each, constructed mostly in the northeastern states where iron ore was mined. A good example is the restored Hopewell Furnace National Park in Pennsylvania, built in 1771.

Iron for rails coupled with dry stone for supporting structures greatly facilitated settlement in interior states and western territories. East of the Mississippi, crews of Irish immigrants, fleeing the potato famines at home, found ready employment as "turnpikers," and canal and railroad builders. In the U.S., they often communed together, moving around the country wherever their skills were needed. Stone work offered employment for many thousands from Ireland, where working with stone had been part of their lives for centuries.

The Louisville and Nashville Turnpike was one of many such projects. The turnpike was first chartered in 1829 by the Kentucky State Legislature with a capitol stock of one hundred thousand dollars. Entirely built with Irish labor, the pike was finally completed in 1859. Three stone bridges of the turnpike exist in an historic park that is now part of Ft. Knox Military Reservation. Unfortunately they have been damaged by concrete pointing that German prisoners of World War II were assigned to apply (Kenpf). Mary Pierce, Director of the Heritage Foundation in Franklin, Tennessee, directed us to three more bridges of the old turnpike that remain in good condition in Sumner, Davidson, and Robertson Counties, Tennessee - excellent examples of nineteenth-century dry stone work.

Dry stone canals, many hundreds of miles long, provided water connections between the agricultural West and the industrial East. Reaching its peak in the 1850s, the canal era produced some 4,000 miles of canals. The 363-mile-long Erie Canal, completed in 1825, linked the Hudson River with Lake Erie, thereby connecting the seaboard with the interior and transforming New York City into a world trade center.

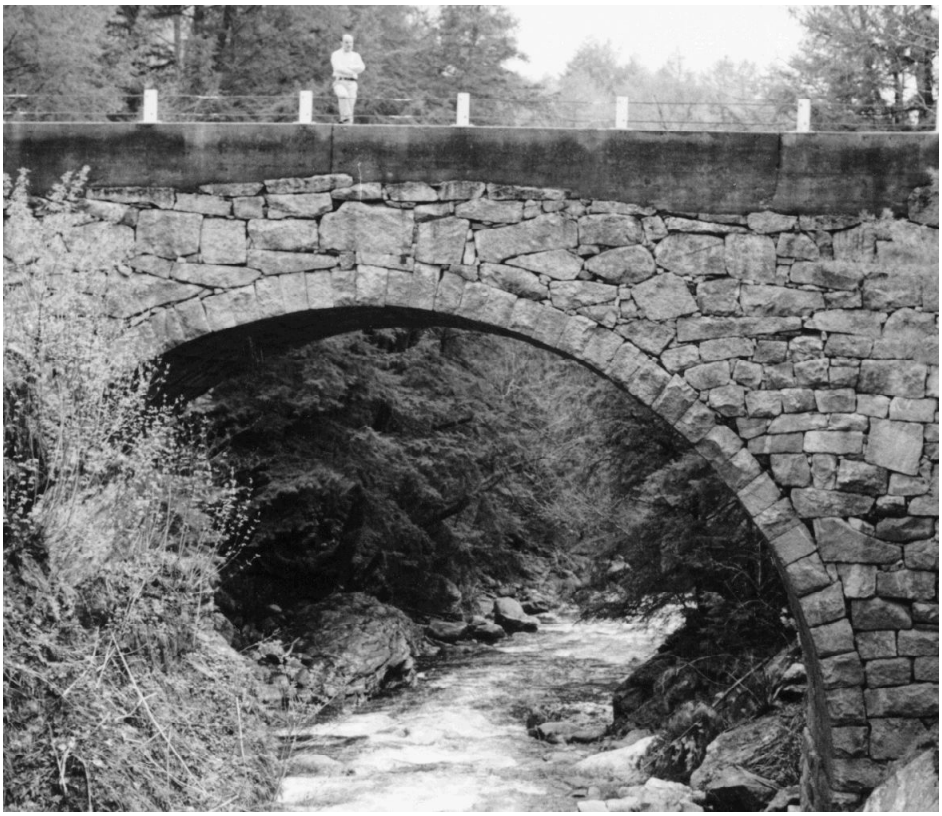
Fitchburg Furnace, Estill County, Kentucky.

The Erie Canal so immediately and vastly altered shipping economics that by 1828 the states of Maryland, Virginia, and Pennsylvania chartered the Chesapeake and Ohio Canal Company to provide "a flatwater route to western wealth. . . . Penetrating 185 miles inland, the C&O Canal was one of the nations's most ambitious industrial experiments of the mid-1800's." The canal opened in 1850, having cost more than eleven million dollars. Masons built mortared and dry stone dams, culverts, embankments, abutments, weirs, spillways, tunnels, and eleven stone aqueducts that carry the canal over creeks and rivers. A series of huge dry stone locks overcame the 605-foot elevation change from the Chesapeake Bay to the Cumberland coalfields at the base of the Allegheny Mountains (National Park Service).

Sue Pridemore, of Delaware and Lehigh National Heritage Corridor, explained that the need to transport increasingly large quantities of coal to markets downriver led to intensive development of the upper Lehigh Valley in Pennsylvania. Between 1835 and 1838, Lehigh Coal and Navigation Company built 20 dams, 29 dry stone locks, and connecting dry stone canals between Mauch Chunk and White Haven. Laborers came from Germany, Ireland, Wales, and Scotland. Josiah White, the canal's builder, recorded in his journal that "I didn't know anything about blasting nor did they. But we were lucky; as I recollect we lost only two men." The builders constructed dry stone locks that lifted coal-laden barges as high as 30 feet.

Picturesque elements amid all this construction include the artfully-arched dry stone bridges spanning the waterways. Some of these remain in use today, supporting weights unimagined when they were built.

"Of some thirty nineteenth-century [dry] stone bridges remaining in New Hampshire, the Gilsum span is preeminent for the dramatic height of its



Gilsum Bridge. Cheshire County, NH. For scale, notice the person on the bridge.

arch and for the rugged picturesqueness of its setting." Built in 1862-1863 to replace five earlier washed-out or rotten timber bridges spanning the Ashuelot River, the bridge arch has a clear span of 47 feet, 8 inches and rises 43 and 1/2 feet above the stream bed (Commoss and Garvin).

The Westfield River dry stone bridges in Massachusetts, built in the 1830's, allowed steam locomotives to negotiate the steep, eight-mile-long narrow gorge. Ten bridges were built of dry stone by Irish and Scottish craftsmen, from square blocks of granite quarried from the surrounding cliffs. Each 50-foot-wide bridge rose higher than the last until the highest arch soars more than 70 feet above the stream below. "Amtrak trains still rumble over three of the bridges, including a graceful double arch in Middlefield (Rolando)."

The intriguing story of the Dolloff Dam in New Hampshire reveals another marvelous engineering feat of the nineteenth century. The gigantic dam, built in 1842, impounded the 800-acre Pawtuckaway "Pond" to provide water power 21 miles downstream by way of the Lamprey River meanders to the Newmarket Cotton Mills. Because there are no quarries nearby; the dam was probably built from the huge glacially-deposited granite boulders that surround the area; tool marks on nearby waste stones indicate that the blocks were split where they lay. The stone was hauled to the dam by wagons or sleds and lifted into tall courses by block and tackle from wooden derricks with masts and booms - all entirely powered by men and oxen. The impoundment continues to supply the Newmarket hydroelectric plant which produces electricity that is sold to power companies throughout New England (Garvin). This wondrous 1842 structure, built entirely of dry stone, is phenomenal on any international scale.

To the coast

The railroads opened a floodgate of settlement and construction west of the Mississippi. The Central Pacific and Union Pacific joined their tracks in 1869 at what is now Golden Spike National Historic Site at Promontory Summit, Utah, heralding the "world's first transcontinental railroad." The railroad grade and its associated features, designated a National Civil Engineering Landmark, include campsites that housed hundreds of workers who built seventeen original drystone culverts and seven trestles with stepped abutments of dry-laid stone retaining walls. The site efficiently illustrates the expanding railroads' dependence on dry stone infrastructures (Anderson and Wilson) .

On the Pacific coast, skills of immigrant Chinese and Italians were put to use building highway and railroad embankments, bridges, and tunnels through mountainous areas; dry stone terraces for the vineyards of California; and miles of aqueducts bringing water from the mountains to the coastal regions.

Dana Supernowicz of the Eldorado National Forest describes California as a melting pot of dry stone techniques because of three major stone-building ethnic groups - Chinese, Italians, and descendants from the British Isles - and numerous minor groups. Their skills made possible the many major dry-stone road-retaining walls constructed from 1860 to 1906, and thousands of miles of dry-stone field walls, built mostly in the sheep grazing areas.

A variety of examples: In the northern part of the state, up to 10,000 Chinese were employed to work on the Central Pacific Railroad. With completion of the railroad, their skills were quickly put to use on other stone work: flumes, irrigation ditches, banks, and dry stone dams using granite blocks 2 x 3 feet in size. The Welsh performed much of the stone quarrying. Swiss-Italians and Italians who settled near Placerville built the entire town of stone - some structures totally dry, some stone and earth, and some

Eldorado National Forest, California, roadway culvert built by Chinese masons. Note the oriental character of the lintel.

with limestone pointing and stucco. In the 1930's, a blending of these skills inspired Bernard Maybeck to design a "Wrightian-style" fireproof resort in the mountains, all of stone with dry stone walls.

Into the twentieth century

Atop the Rocky Mountains, Glacier National Park engineer Goodwin proposed a roadway to cross the continental divide in the early 1900s. Surveying and engineering plans were complicated, and after a series of disagreements Goodwin resigned from the project. Following revisions by Thomas Vint, in 1924 the park awarded the Going-to-the-Sun Road contract to the firm of Williams and Douglas, who it turn subcontracted work to a series of builders from various countries, including Russia. A monstrous 54-foot-tall dry-stone retaining wall supports a major "loop," making climbing the grade over the mountain possible in one loop instead of 15 switchbacks. The road was pivotal to transmountain travel before the advent of federal Works projects in the 1930s and 40s, and is listed in the Historic American Engineering Record. (Gordon).

Practical dry stone construction projects continued in the twentieth century even during the Great Depression, when a variety of public works relief agencies offered employment. The Public Works Administration (PWA), Works Progress Administration (WPA), and the Civilian Conservation Corps (CCC) provided work for huge numbers of jobless laborers, many of whom already had, or quickly acquired, basic dry stone skills. These government initiatives included the still-in-use dry stone trails, dams, erosion controls, retaining walls, and roadways of the national parks, from the Channel Islands in the Pacific to Acadia in Maine.

Dry stone work supporting Rim Rock Drive in Colorado National Monument is being carefully maintained by John Tordoff, Facilities Manager. Massive stone retaining walls that hold fill along the cliff face and support the Rim Rock Road shoulders are a combined legacy of the WPA and the CCC. Both dry and mortared stone work of Rim Rock incorporate the naturalistic or rustic styles preferred in national park construction. The WPA employed local Italian stone masons to direct the original construction and training for 2,500 CCC workers. The masons quarried construction material from the cliff face, using air drills to split off the rock. Crews built the walls entirely by hand, using picks, shovels, wheelbarrows, and for lifting the larger stones, block and tackle. Observers of the day described the road as "one of the most impressive legacies of the CCC in western Colorado." Tordoff also organized instruction for national parks maintenance personnel to repair Serpent's Trail, which climbs the north side of No Thoroughfare Canyon, and has 27 switchbacks supported by retaining walls of coursed, dry-laid rubble.

Now

Dry stone work, built without mortar, is remarkably durable, relying on the skill of the craftsmen and the forces of gravity and frictional resistance. It withstands fire, water, decay, and insects. The mason needs only a few basic tools; the structures are easily repaired; the material is readily available and recyclable; and the work does not deplete resources. Little wonder, then, that building in dry stone is an eternal practice.

When correctly built, dry stone walls are even earthquake resistant. Scottish masons recently completed a dry stone wall near Seattle, Washington. Local observers kept asking what kept the wall together. They could not understand strength without cement. These questions were resoundingly answered in March of this year with the devastating 7.0 Seattle earthquake when the wall survived totally intact, merely settled more firmly into place (Aitken and Rippingale).

There are impelling reasons to continue and preserve this ancient craft today - to protect historic structures, provide worthwhile rural employment, promote tourism, and preserve beautiful landscapes. Most importantly, dry stone masonry is STILL a viable building technique as hundreds of thousands of architects, landscape architects, engineers, developers, landowners, and gardeners are excitedly re-discovering. Local stories, hidden structures, secret "finds," and family traditions enthusiastically come to life with re-embraced skills that use, protect, and build on this shared heritage.

REFERENCE LIST:

Aitken, Nick, and Neil Rippingale. Shaken, But OK. The Waller and Dyker [Periodical of the Dry Stone Walling Association of Great Britain]. p.3. Spring 2001.

Allport, Susan. Sermons in Stone: the Stone Walls of New England and New York. New York: W. W. Norton. 1990.

Anderson, Adrienne B., and Rick Wilson. The Unheralded Resources of Golden Spike National Historic Site. CRM [Cultural Resource Management]. no.10, pp.12-14. 1999.

Commoss, Harriet, and James L. Garvin. Gilsum Stone Arch Bridge. National Register of Historic Places. Washington: National Park Service. July 1989.

Fig, Don F. A History of the Fitchburg Furnace. United States Department of Agriculture, National Forest Service. no date.

Gardner, Kevin. The Granite Kiss: Traditions and Techniques of Building New England Stone Walls. Woodstock, Vermont: Countryman Press. 2001.

Garvin, James L. (Architectural Historian). New Hampshire Division of Historical Resources. personal interview and telephone interview. May 1997 and June 2001.

Gordon, Jack. (Landscape Architect). Glacier National Park. telephone interview. June 2001

Kenpf, Gary K. (Instructional Systems Specialist). Directorate of Training and Doctrine Development, Fort Knox, Kentucky. personal interview. April 2000.

Simmons, R. Laurie and Thomas H. Rim Rock Drive Historic District, and Serpents Trail. National Register of Historic Places. Washington: National Park Service. March, 1993.

Madl, Diane. Lehigh Gorge State Park Interpretive Plan. Pennsylvania Department of Conservation and Natural Resources. typescript. May 1997.

McCarthy, Celia, and Richard Lerner. Oakland Harbor Training Walls. National Register of Historic Places. Washington: National Park Service. July 1997.

Murray-Wooley, Carolyn. Early Stone Buildings of Kentucky, Part I. National Register of Historic Places. Washington: National Park Service. February 1983.

Murray-Wooley, Carolyn and Karl Raitz. Rock Fences of the Bluegrass. Lexington: University Press of Kentucky. 1992.

National Park Service. Chesapeake and Ohio Canal. Washington: Division of Publications. 1989.

Pierce, Mary (Director). Heritage Foundation of Franklin and Williamson County, Tennessee. personal interview. April 2000.

Pridemore, Sue (Executive Director). Delaware and Lehigh National Heritage Corridor. personal interview. May 1997.

Rolando, Vic. Stone Arch Bridges Make News in Massachusetts. Society for Industrial Archeology; New England Chapters [Newsletter]. v.17, n.21, p.5. 1997.

Supernowicz, Dana (Historian and Librarian). US Forest Service, Eldorado National Forest. personal interview. November 1997.

Tordoff, John (Facilities Manager). Colorado National Monument. personal interview and telephone interview. November 1997 and June 2001.

Carolyn Murray-Wooley is an architectural historian, the Director of the Dry Stone Conservancy and a Stone foundation member

THE LOGIC OF STONE

an advocate looks at the benefits of dry stone masonry.

Jane M. Wooley, ASLA

Dry stone masonry --the method, material, and process of combining stone into all manner of structures without the use of any mortar-- is a disappearing craft in North America. Within the craft lies the promise to authentically restore thousands of historically significant dry stone structures that have survived the centuries. This sensible technique offers landscape architects one of the most responsible, expressive, and versatile building methods ever developed. Unfortunately, it is all too rare to find craftsmen, or design professionals, with a deep understanding of the principles and issues involved.

Dry stone bridge and channel lining. Cherokee Park, Louisville KY

But in the heart of Kentucky's celebrated horse farm countryside, the nonprofit Dry Stone Conservancy (DSC) is spearheading an effort to preserve historic rock fence landscapes and the craft that built them. The DSC was formed as an outgrowth of a Kentucky Transportation project to train masons to relocate historic fences affected by road-widening projects, but its mission has become more ambitious: to "revive the craft [of dry stone masonry] and preserve its structures" nationwide. Partnerships with the National Park Service, Kentucky's Transportation Cabinet, the Heritage Council, local governments, and other organizations are already in place. The program includes extensive training of masons, technical assistance, and public education. The goal is a future in which design professionals turn often to dry stone masonry as the best practice for many needs. The craft has the potential to become a thriving industry if it is thoroughly underpinned by education, skills certification, specifications, testing, and standards.

Why should landscape architects and designers want to use dry stone masonry in their projects? To begin with, the versatility and aesthetic appeal of natural stone is unsurpassed. The variety of textures, colors, shapes, and sizes--and the adaptability to any desired geometry--make for an expressive building medium. Dry stone lends itself to the mundane and functional as well as to the fanciful and whimsical. " I like the flexibility of the craft," says Richard Weber, landscape architect and owner of Springhouse Gardens in Nicholasville, Kentucky. "Dry stone allows a designer to make changes and really work with a site in a way that, if you were working with footings or more stringent construction techniques, you wouldn't be able to do. It allows much more freedom in design, working with organic sinuous lines."

Dry stone masonry offers environmental and ecological benefits as well. Rock is a nontoxic building medium. With gravity and friction its only binding agents, the harsh chemicals, additives, and lubricants common in the construction industry are not needed. Most projects can be built without additional machinery or power tools, reducing fuel consumption during construction. Dry stone is fully sustainable and recyclable; because no mortar is used, a dry stone structure can be completely dismantled and its rock put to new use.

A skilled dry stone mason cleverly works with natural laws and forces. Gravity, water pressure, and ground movement are rendered harmless as structures are fashioned that

This nineteenth century roadway retaining wall in Louisville's Cherokee Park was built with faults that led to its collapse in 1995.

drain freely and flex benignly. They sit lightly on the land; foundations to frost depth are not required. "One thing I especially like about dry stone is that there is less site invasion with equipment and materials," says Bill Henkel, ASLA, owner/partner of Henkel Denmark, a design-build firm in Lexington, Kentucky. "All you need is to level a setting bed, then it is just stone and people. There is less tearing up the site, no gaping holes in the ground for foundations or footings, no concrete trucks, no steel, no footings to dig."

Because of its open architecture, dry stone is ideally suited for situations where water is a problem. The entire structure drains freely, making it ideally suited for retaining walls. Structures that are routinely inundated--culverts, head walls, streambank protection, channel lining, bridge abutments--are particularly appropriate for dry stone. When used as streambank lining, dry stone allows groundwater to filter into the channel, sustaining aquatic life through periods of drought. The interstices create microhabitats that sustain communities of plants, insects, and animals.

Practically and economically, rock--the craft's only material--is often plentiful right at the building site, although retrieving it may require some effort. Few tools are needed, so start-up and overhead costs are low and access to remote locations is relatively simple. Hammers, some breaking and shaping tools, a shovel and axe, and a bit of string and wood suffice for most projects.

Surprising to most, dry stone masonry is quite cost competitive with modern alternatives. "The cost to authentically rebuild a seventeen-foot-high dry stone wall in Cherokee Park was significantly less than the alternate solution of a poured-in-place concrete and stone veneer wall," says Mike Smiley, ASLA, of Environs, Inc., and designer of several Olmsted Parks projects in Louisville, Kentucky. Because the volume of dry stone structures increases geometrically in proportion to height, and because rock types vary considerably, it is impossible to assign a square-foot price for dry stone masonry as is customary for mortared work. To give some idea, however, experienced DSC-trained masons charge $150 to $200 per linear yard to rebuild a typical four-foot tall double-faced historic rock fence. This "yardstick" cost is based on an average lay rate of approximately two yards per worker per day, using randomly bedded limestone and building to internationally accepted standards for the craft. A new fence construction adds the cost of rock, approximately one-and-a-half tons per linear yard for a fence of the same specifications. "I haven't found the cost to be prohibitive," says Webber, "especially for the smaller and mid-sized projects. The way I view it, people are more willing to pay for something they view as art or a piece of sculpture." Henkel has found that dry stone "is just about the same price as rigid wall systems, within a few percentage points of each other."

This pre-civil War cemetery wall in Fafette County, Kentucky, was previously in complete ruins. The DSC restored it while training masons in the drystone craft.

The challenges in using dry stone

The wall has been completely restored at a lower cost than that of modern alternatives.

masonry are many. The principles of dry stone use are not taught in professional design programs. Technical information is scarce and scattered. The technique is not supported by testing data or standard specifications. Historical remnants currently offer the only bona fide evidence of structural viability. Stone can be expensive if it must be purchased and transported. Masons and contractors are geared to mortar work.

The craft is completely unregulated. Anyone wishing to "stack rocks" can sell himself or herself as a dry stone mason. Skilled dry stone masons will be the first to attest to the problem they confront every day: The scores of semiskilled masons and opportunists impede the search for true craftsmen. Because dry stone masonry is material, art, craft, and trade rolled into one, its practitioners are a mixed bag of craftsmen, artisans, and tradesmen, each approaching the craft with a different focus. Some are devoted to the structural principles. Some are inspired by the material. Some just want to make a buck.

The craft is further hampered by the mistaken assumption that, because its principles are logically simple, anyone with a strong back can do it. The fundamentals of dry stone masonry are indeed straightforward, but it takes years of practice to become a journeyman and many more to earn the title of master craftsman. Another prevalent assumption is that, because the material is stone, a reputable mortar mason is more than capable of doing dry-laid work. In fact, mortar masons find the transition quite difficult because they usually depend on mortar rather than interlocking stone for structural cohesion.

The DSC is taking action to meet these challenges as it develops and tests its model program for the revival of the craft. The DSC's partnerships with the National Park Service, Kentucky Transportation Cabinet, Kentucky State Parks, and other agencies have resulted in training courses, restoration and demonstration projects, standards and specifications for publicly funded construction projects, grant programs, job development initiatives, and preservation ordinances.

Dry stone masons are at the heart of the effort. The DSC is aware of no other formal training, testing, and registration programs dedicated to producing highly skilled and knowledgeable dry stone masons. In addition to training masons, the DSC represents their interests in trade issues, as well as maintaining and disseminating the only state-sanctioned Register of Independent Dry Stone Masons in North America. Previously, there was no reliable source within the United States where one could find qualified dry stone masons.

To prevent the dismantling of old dry stone structures as a rock source, and to lower the costs to project owners, the DSC is developing reliable sources of inexpensive building rock.

The DSC seeks funding from a variety of sources. This year, for example, a General Electric Environmental Stewardship Grant (one of only nine awarded worldwide this year) will support an urban stream channel project in Lexington, Kentucky, and TEA-21 funds will support a project to train and prequalify dry stone masons to relocate a mile of endangered rock fence in rural Kentucky.

DSC training projects include relocating historic rock fences affected by roadway projects.

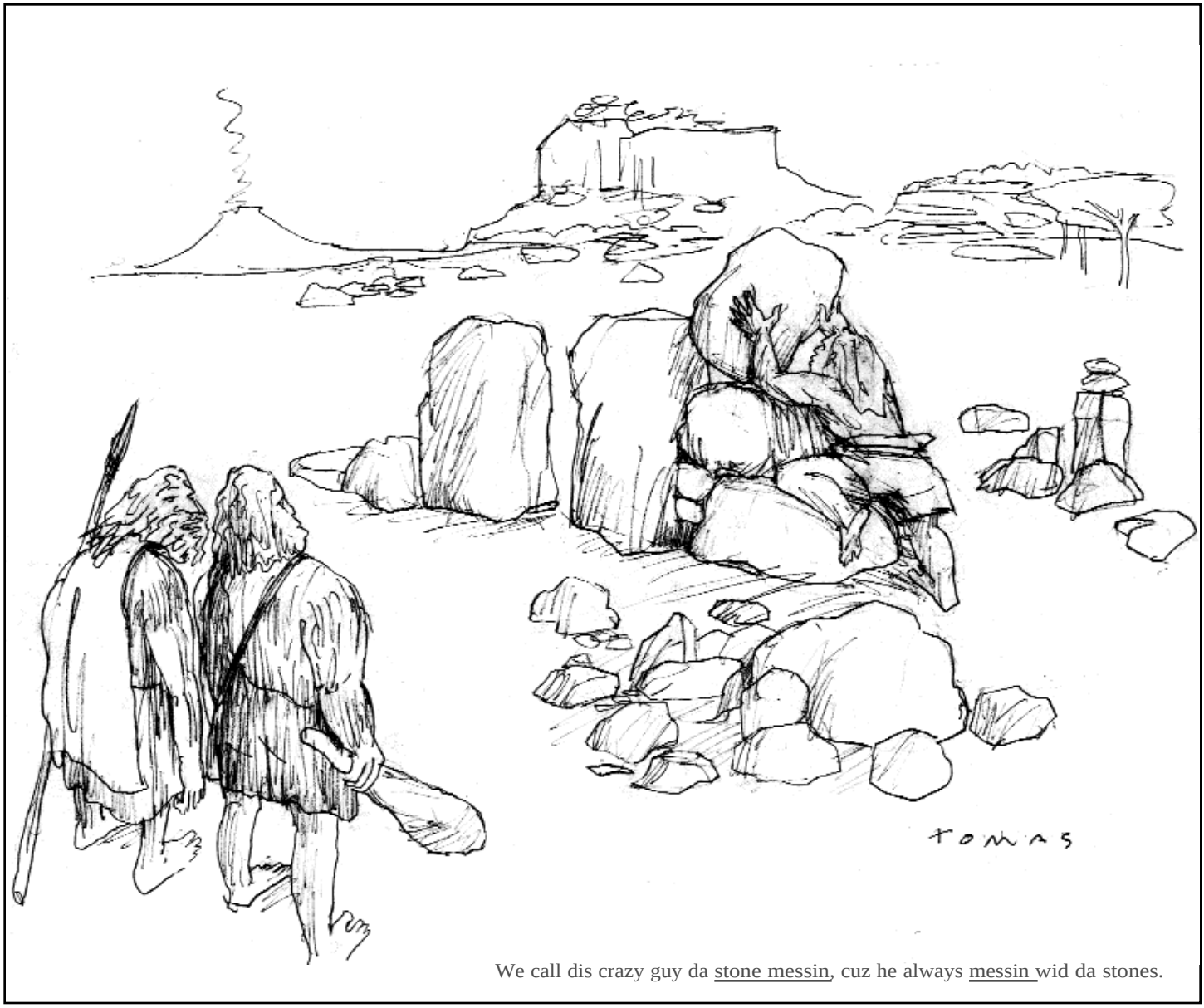
Back to Table of Contents
Stone Foundation Home Page

The DSC is producing and making available a range of high-quality training and information materials. As landscape architects become educated, we will settle for nothing less than high-quality workmanship. A firm grounding in the principles that underpin the craft will allow us to confidently design and specify dry stone projects and intelligently interview the masons who will build our creations. In Kentucky, landscape architects already specify dry stone masonry into their projects. "Before the Conservancy-trained masons I wouldn't seriously consider dry stone," says Webber. "I would think about it, maybe even suggest a good place for some dry stone work, but there wasn't anybody I could recommend to build it. Now we can run with it. We're designing beautiful projects that are workable and do-able."

Jane M. Wooley, RLA, ASLA, is program director at the Dry Stone Conservancy in Lexington, Kentucky.

Resources

Dry Stone Conservancy / 1065 Dove Run Road, Suite 6 / Lexington, KY 40502
859-266-4897 / 859-266-4840 / DryStoneKY@aol.com



We call dis crazy guy da stone messin, cuz he always messin wid da stones.

Someone there is who loves a wall

tighter, neater, faster -- steven allen may be the best wall builder in the world

by Michael Finkel

Originally published in the Atlantic Monthly Magazine, May 2001.
Reprinted with the permission of the author.

Steven Allen does not philosophize about stone walls. Plenty of other people do, but not Allen. He is generally a quiet person -- a result, perhaps, of spending much of his time alone, in the countryside, sorting through piles of rock. About the closest he'll come to proffering large thoughts is to say something vaguely Zenlike, such as "A stone is a stone." As with many of the things Allen says, more can be read into this than is at first evident.

The majority of wall builders will tell you that a stone, professionally speaking, is not always a stone. Wallers tend to specialize in a single kind of rock, typically the one found in their home county. Slate might be a stone, and limestone might be a stone, but granite represents little more than a series of frustrations. Allen, however, is a Cumbrian waller. People who are familiar with wall building in Great Britain know that Cumbria, a rural county in northwestern England, is something of a melting pot rock-wise. "There's slate where I live," Allen says. "Two miles that way is limestone. Ten miles this way it's all sandstone, and ten miles the other way it's nothing but granite. I don't differentiate. They all make fine walls."

Allen is thirty-nine years old. His hair is brown and curly and responsive to neither comb nor brush. He has a squarish jaw, thickly callused hands, and forearms apt to make an observer wonder whether Allen's diet consists chiefly of spinach. He is six feet three inches tall. He has never had so much as a day of formal training, and he can't recall a time when he did not know how to build a wall. As a child, growing up on his family's sheep farm, Allen spent much of his playtime piling stones: "My father used to say to me, 'Put a few boulders on a wall if you want to do something useful.'" Allen attended school until age sixteen and then became a farmhand, working on his family's land and at larger operations. Wall repair was a never-finished task -- one that most workers loathed but that he found strangely satisfying. He decided to specialize.

Since 1988 Allen has worked full-time as a dry-stone waller. He walls nine hours a day, six days a week, every week of the year. On Sundays, instead of resting, he often returns to the family farm and walls there, too. Allen can safely be described as the best dry-stone waller in Great Britain. By extension, he may well be the best wall builder in the world.

A dry-stone wall is constructed without cement or mortar. It is held together solely by its own weight. Such walls were being built prior to recorded history; in Ireland the remains of field walls have been dated to the late Neolithic period, about 1750 B.C. Construction methods have remained essentially unchanged for centuries.

A well-built dry-stone wall can stand intact, without needing repair, for 200 years or more -- several times the lifespan of a cemented wall. Dry-stone walls shift and bend in order to conform to the natural movements of the land -- the frost heaves, the sinkholes, the settlings in the rainy season. A dry wall that is distorted and bellied and yet still fairly sturdy has reached what Allen calls "old age." Cement walls do not reach old age. Cement walls do not move. They crack, and then they fall. "Cement," Allen says, "is a sin."

On the other hand, a poorly built dry wall -- a "cowboy wall" -- sometimes does not last a single winter. The stones in a cowboy wall may not all tilt slightly downward, like roof tiles, so that water can drain out of the wall. The pebbles and rock chips placed in the wall's center -- the "hearting" -- may not be packed tightly enough in a cowboy wall, robbing the structure of critical strength. Allen's walls generate no such concern.

Wall building does not sound like an activity in which one can determine a best. Is there a best chimney sweep? A best horseshoer? Surely some in each of these fields are more skilled than others, but selecting a champion seems

an exercise in arbitrary judgment. Walling, though, has had an unusual evolution compared with most other professions -- one that has transformed it from an industry to a relic to an art form to a sport.

The Parliamentary Enclosure Acts of the eighteenth and early nineteenth centuries, which were intended to promote more-efficient farming methods, sparked a wall-building frenzy in Great Britain. Scores of men (walling was, and still is, an almost exclusively male occupation) left farms and mines to become wallers. By 1850 virtually every field in the nation had been enclosed. Some 70,000 miles of stone walls were built in England alone.

Ironically, the exceptional durability of dry-stone walls almost killed the profession. Once all the walls had been finished, wallers had little to do. When the enclosure-era walls finally began to tumble, in the mid-1900s, almost no one alive was capable of expertly repairing them. Barbed wire became the fencing method of choice. At the time, some historians predicted that by the twenty-first century the famous walls of the British farmlands would have vanished forever.

This has not happened. Though it is estimated that only four percent of England's walls are in pristine condition, and repairs to save the rest might cost as much as $4.8 billion, the dry-stone walls of Great Britain will apparently endure. Two developments helped to save them. The first was the founding, in 1968, of the Dry Stone Walling Association of Great Britain, a nonprofit organization dedicated to the preservation of walls and the walling profession. Thirty years ago the association had scarcely a hundred members. Now it has more than a thousand, including 250 professionals -- still a tiny number, considering the extent of needed repairs.

The second development was entirely unplanned. As in the United States, in Britain of recent years people have tended to move away from urban centers and into suburbs and smaller towns. One of the results of this population shift has been a renewed appreciation for the aesthetic appeal of dry-stone walls. Over the past decade walling has come to be regarded by those who have left the city as a kind of rural artistry -- comparable, perhaps, to the way fly-fishing is regarded in the United States. Wall-building classes and even corporate wall-building retreats now exist. An environmental group has published a booklet that teaches weekend wall ecologists to identify the eleven species of lichens, fifteen species of birds, eighty-four species of vascular plants, ten species of snails, and six species of woodlice that live on walls. Not long ago Allen was commissioned to construct a stone wall in an art gallery at the University of Hertfordshire. Walling, in short, has become hip.

For many years county fairs in rural Britain have featured, amid the stock shows and bake-offs, wall-building contests. In these, wallers construct or repair sections of wall, and judges determine who displays the finest craftsmanship. Until recently these were low-key affairs, little more than social gatherings aimed at countering the solitary nature of the profession. Since 1991, though, the Dry Stone Walling Association has organized the better-established competitions into what it calls a Grand Prix. Grand Prix contests are held throughout the country, in regions with widely varying stone types and building styles. Participating wallers are awarded points according to finishing position. The person with the most points at the end of the summer is declared the national champion, and is generally regarded as the top waller in Britain.

Allen has dominated these contests. He won the inaugural Grand Prix and has since won four more, including the past two. No one else has won more than two. As walling has increased in popularity, so, too, have the contests; they are now regularly covered in newspapers and on television. Allen's victories and burgeoning reputation have led to walling commissions in the United States and Europe. He has helped to construct several dry-stone installations for the sculptor Andy Goldsworthy. Once, for an advertising campaign, he built a thirteen-foot-high dry-stone rendering of a Johnny Walker Scotch bottle. A writer and part-time waller named David Griffiths recently published a biography of Allen. Within the British wall-building community Allen has become a celebrity.

Last June, at the peak of the competitive wall-building season, Allen agreed to let me accompany him to a Grand Prix event. He lives with his wife, Susan, their twelve-year-old daughter, Hannah, and their infant daughter, Megan, in the Cumbrian village of Tebay, two hours' drive north of Manchester. Tebay, population 700, sits in the heart of British sheep-farming country. Allen's family has lived here for generations. Walls are everywhere, splotched with lichen, by turns twisted and plumb, bracketing the country roads and running like skipping stones over the dark-green fells direct to the feet of the mountains -- the Cumbrians to the west, the Pennines to the east. Allen's home, a stuccoed townhouse, is modest -- wall building is no path to riches -- and constructed with nary a rock ("Thank goodness," he says).

Competitions are typically held on Saturdays. We left in Allen's car for the Yorkshire Open just after sunrise -- or at least just after the sun was scheduled to appear. The skies over Cumbria, as far as I could tell, have two moods: mostly cloudy and entirely cloudy. "I work in the rain so often," Allen told me, "that I don't even notice anymore when it's raining." A few years ago, while building a wall on the Isle of Mull, he labored in a rainstorm that persisted without

pause for a week.

For the Yorkshire Open, held in conjunction with a county fair in Honley, a small town on the east side of the Pennines, Allen was wearing clothing a half step dressier than his usual work attire. Instead of muddied blue jeans he wore clean ones; for a tattered T-shirt he had substituted a bright polo shirt. His supplies and provisions were stuffed into a plastic bucket: gardening gloves, a bottle of sports drink, a few cheese-and-tomato sandwiches, and two well-worn hammers, one of which he'd kept in water overnight in order to tighten up the head.

We spent much of the ride in silence. Allen seemed to find this comfortable. One might almost say he is shy; certainly he is unprepossessing and free of pretense. The previous evening, when I'd insisted on taking him to dinner, he had chosen a fish-and-chips shop; we ate on a park bench and wiped our hands on our pants. He doesn't easily speak about himself, and when coerced into doing so he has a tendency to downplay his skills. "I don't want to be called an artist," he says. "I'm a dry-stone waller. It's a job."

Clearly, though, he is not only passionate about his work but also fiercely competitive. We had left at sunrise so that Allen could be the first to arrive at the contest site, as always, giving him maximum time to study the task at hand. Nearly every flat surface in his house supports a walling trophy. When I asked about his accomplishments, soon after I met him, he handed me four scrapbooks fat with newspaper clippings and then retired to the living room to watch soccer on television. Allen, I learned from the clippings, had entered his first contest in 1984 -- the Derbyshire Limestone Championships. He was awarded first prize in the amateur division. In 1991 he won six of the eight Grand Prix contests he entered; in 1994 he won six of nine and announced his retirement from competition. Like a number of sports celebrities, he promptly unretired at the start of the next season. Going into the Yorkshire Open, he had lost only one contest (he finished second at the 1998 Eden Valley competition) in the past two years.

The Yorkshire Open was staged on a bluff overlooking the rest of the fair. A length of decrepit wall had been roped off; the competitors would have to tear it down and then build a fresh wall in its place. Wooden stakes demarcated individual sections. Allen was indeed the first competitor there. He pulled on his leather work boots and paced the length of the wall, seemingly lost in thought. Soon a stocky man with a bristly red moustache, wearing deeply stained overalls, arrived. He was David Griffiths -- the author of Allen's biography. He had come from the nearby city of Leeds, where he worked as a playwright and a teacher. Griffiths was a classic wall-building philosopher. "I find walling therapeutic," he said. "It clears my mind of clutter; it's meditation to me. Walling and writing complement each other nicely. Walls tend to be in peaceful settings, in the country. Once I get a wall going, it sort of goes by itself, and it's then I'm able to do my best creative thinking."

I asked Griffiths if he considered wall building to be an art form. "In some cases, yes," he said. He lifted his chin in Allen's direction. "I think Steven has a particular eye for the way stone assembles, the way it looks. He is clearly the best waller in the land. No matter the stone, his walls are tighter, and neater. He works faster than anyone else, and at a higher level."

Fifteen wallers -- fourteen men, one woman -- eventually showed up, along with four judges, a referee, a chief steward, and a clutch of onlookers. Numbers were drawn from a hat, and the competitors moved to the corresponding segments of wall. A whistle was blown, and the contest began.

I saw immediately that walling is hard physical labor. A standard four-and-a-half-foot-high stone wall weighs approximately 1.75 tons per yard of length; competitors in the professional class had to build two and a half yards -- to lift more than four tons of rock in the eight hours of the competition. In his book, Drystone Dyking (Scottish walls are called dykes), the longtime waller Robert Cairns described an old wall builder as walking "half shut, bent from the hips with constant stooping." Cairns's conclusion about walling seemed apt: "This is art and brute force combined."

The day started with an exercise in brute force -- the removal of the old wall, a process called stripping out. Everyone had a slightly different method. Some tore haphazardly at the wall, grabbing two or three rocks at a time and tossing them down. Others laid their stones in neat piles, one by one, organized by size. Allen worked more quickly than most, though he paused for an instant as he gripped each stone, as if memorizing its form, before tossing it behind him into a loose semicircle of larger rocks to his left, smaller to his right.

When the space before them was reduced to bare earth, the competitors began to build. In Great Britain there are as many walling styles as there are counties. These include Galloway dykes, Devon chip-and-blocks, Cornish hedges, Welsh cloddiau, Cotswolds cock-and-hens, Dartmoor singles, and Cornwall Jack-and-Jills. Walling aficionados can study a dozen books dense with technical specifications and confounding with regional vocabulary. An example: a small passage built into a wall to allow sheep but not cattle to pass through is called, depending on one's location, a cripple hole, a sheep creep, a hogg hole, a lunky, a lonky, a smout, a smoot, a smoose, a thirl, or a thawl.

At the Yorkshire Open the task was to build a common sort of wall, known as a double. Yorkshire double walls

have two faces of stone with hearting packed between; halfway up is a layer of "throughs" -- large, heavy rocks that bridge the two sides and help tie the wall together. The wall features a "batter," or taper, of 1:12 -- that is, it becomes an inch narrower for every foot it rises -- and it is capped with a ridge of triangular stones, called copes. Judging takes account of, among other things, the soundness of one's foundation, the effectiveness of one's throughs, the tightness of one's copes, and the exactness of one's batter.

I watched Allen work. He'd stand stock-still for a moment and stare at his wall with a calculating look on his face. Then he would swiftly turn around and bend down and select a stone. He'd twist it and jiggle it and flip it over and back, as if fiddling with prayer beads. Then he'd pick up his hammer, hold the stone to his thigh, and chip off pieces with a few sharp taps. One of the qualities that sets Allen apart from other wallers is his feel for the hidden seams snaking through a rock. He can't quite explain how he knows where it will break; he just knows. When Allen hit a rock, it invariably fractured along a plane as smooth as a sail. He'd flip the rock one or two more times, perhaps tap it again with his hammer, and then place it on the wall with a pat from his palm. If he was setting it into a space between two others, the rock would literally click into place, wedged between its neighbors as tightly and neatly as if Allen were building with Lego bricks. He'd nod, reach down and sweep up the chips he'd broken off, and pack them into the center of the wall. Then he'd study the next gap for a second or two, spin around, and pick up another stone.

Within an hour I could see that Allen faced only two real contenders for the trophy: a ponytailed, chain-smoking thirty-eight-year-old Welshman named Sean Adcock, who had been a runner-up for the 1997 Grand Prix; and a fifty-one-year-old from Derbyshire named Trevor Wragg, who had won the Grand Prix in 1996. Most of the other wallers were struggling with the stone, a sharp, coarse-grained variety called gritstone. "Horrible stone," one mumbled; "Pure rubbish," another said. Several competitors, unaccustomed to building Yorkshire-style walls, appeared bewildered at times, incapable of coaxing their stones into alignment. Judges paced back and forth, conferring and pointing and jotting notes. Allen worked like a machine, breaking his rhythm only to sip his sports drink, toiling in silence save for the clink of hammer against rock.

The crowd was small (walling is not much of a spectator sport), but those who watched seemed knowledgeable, muttering about weak-looking foundation stones and misaligned rows. "People will bicker for years over one stone placed in the wrong spot," said Bill Noble, an onlooker who was studying Allen's work. Noble described himself as a "folk-singing waller." He'd been building walls, he said, for twenty-seven years. In 1997 he was Grand Prix champion; today, though, he didn't feel like competing.

As the event progressed, a drizzle stopping and starting, it became apparent that Allen was in for a challenge. It was not his best walling day. One rock low in his wall was slightly crooked; another had an annoying bulge. As his stock of remaining stones started to thin, Allen began having trouble finding the right one for the job. He'd pick up five, six, seven stones, and toss each one down, seemingly

disgusted. For the first time all day he began to sweat. Noble pointed out a place where Allen had made a mistake: two rocks, one above the other, ended at the same point instead of overlapping, creating what is known as a running joint. Ideally, the gap between every pair of rocks in a wall is covered top and bottom. Both Sean Adcock and Trevor Wragg were keeping pace. "When the stone isn't going right," David Griffiths had told me, "you look at the wall and your head is just screaming. You know that one stone wrongly placed changes the effect of the whole." The closest Allen came to airing his irritation, though, was when a spectator asked him what he thought of the Yorkshire stone. "I've seen better," he said, and continued building.

Eventually Allen worked through his problems and was back to building a superior wall. In competition each waller is responsible for making sure that his section ties securely into his neighbors' sections. The result, at the end of the day, is one unbroken stretch of wall, though of widely varying quality. Allen took his time with the cope stones, making sure the triangular tops formed an even line; then he cleaned up his site. His wall looked simple and beautiful and solid, worthy of a two-century run.

Soon the competition was over. The wallers, abruptly released from their labors, wandered about looking lost. I spoke with one of the judges, an elderly man named Bryan Hough, who was recently named the national president of the Dry Stone Walling Association. Hough let me in on a secret: Allen had won. "That running joint nearly did him in," he said. "Take that away and nobody else would be close. But Sean laid a poor foundation stone, and it showed throughout his wall. And Trevor had to hurry to beat the cutoff time, and his copes are loose."

Once the official announcement was made and Allen had collected his trophy and token prize money, he stuffed his belongings into the car and we swiftly departed. "You have to concentrate the whole time," he said, critiquing himself aloud. "One slip and it can be over. I slipped, and I'm lucky I won. If I were the judge, I'd have given it to Trevor."

As Allen spoke, we passed through the city of Huddersfield. The stone walls suddenly ended, and everything turned to brick. After staring at stone walls all day, I found that the brick seemed garish and artificial, like a cheap toy. I was reminded of one of Allen's sayings: "Everything is more or less in wall building," meaning that no matter how neat a wall appears, each stone is still in some small way slightly imperfect. I repeated his aphorism out loud.

Allen glanced at me and looked out the windshield and understood what I'd been thinking. "Laying bricks," he said, "is the most boring thing I can imagine."

Herringbone Wall, Catalunya, Spain

Agricultural Storehouse, West Bank, Israel

Rebuilt Wall, Himeji Castle, Japan

Retaining Wall, Island of Sifnos, Greece

Photographs by Tomas Lipps

Crossroads Salamander

by John Burnell

photo: Mark Rea

European explorers in North America encountered a number of mysterious earthworks at various sites in the upper midwest left behind by long-gone peoples. While some of these forms were simple burial mounds, others were found to resemble shapes of creatures -- birds, bears, panthers, turtles and snakes. Since their initial discovery some two centuries ago, numerous professional and academic careers have been expended in an effort to speculate the meaning behind what has come to be termed "effigy mounds."

The occasional presence of charred embers within these mounds and a long tradition of animism among native cultures usually suggests a ceremonial significance to these forms. However, were one to literally apply the circumstances surrounding the creation of a similar structure today to that of the distant past, then one possibility, among the many hundreds previously postulated, could point towards some sort of antediluvian playground.

"Crossroads Salamander," a stone sculpture in Amherst, Massachusetts, has become just that, upon its installation in a public park in 1998. The creation of local landscape designer/builder John Sendelbach, "Crossroads Salamander" is a likeness of the amphibian creature that, with its prehistoric anatomy rendered in dry stone construction, brings to mind an ancient effigy mound.

The sculpture was initially funded through the Massachusetts Arts Lottery, an arm of the state lottery that distributes money to various localities on a per-capita basis. It was then administered through two other agencies, the Amherst Cultural Council, an umbrella arts organization, and the Amherst Public Art Commission, the latter being a panel of citizens devoted exclusively to the display of public art in the western Massachusetts town. The APAC sponsors an annual program called "Visiting Art," wherein artists are invited to "display and sell works of art not readily exhibited in indoor galleries." The jury-selected pieces are then earmarked for display in several locations on public land in town for a period of one year. The artist receives a $1500 honorarium, maintains ownership of the piece, and may sell the work without being charged a commission upon the conclusion its year-long display.

Sendelbach, a partner in a local landscape design company, responded to a posting for the proposal and came up with the idea of a salamander sculpture for one of the targeted areas, a common on the north end of town. The salamander "effigy" was inspired by the fact that the town of Amherst went to the expense of building several tunnels underneath a nearby roadway to accommodate a yearly migration of the creatures seeking mates across the way. As for building materials, Sendelbach, who had built extensively with stone in his business, proposed a replica of the amphibian in stone that users of the common could engage in, as both a walkway and use as a bench.

According to several members of the arts commission, Sendelbach's proposed salamander immediately stood out from the other entries, not only for its acknowledgment of the town's relationship with the local salamander but also for its proposed dry stone construction. The latter aspect further enhanced the sculpture's regional identity, as the New England countryside is distinctive for its wealth of dry stone walls.

The plan, upon its unanimous acceptance by the arts commission, did meet a snag or two, most notably from nearby residents of the common who, while not objecting to the aesthetic value of the proposal, felt left out of the decision-making process. Too, safety concerns were aired, as the initial site was felt to be too close to an intersection, necessitating a relocation of the piece to another section of the common. Once these issues were resolved in a series of public meetings in which the artist participated, construction began.

Sendelbach and several crew members staked out the site, removed a layer of subsoil and laid the foundation course on a 6" bed of stone chippings. The succeeding courses were laid in the same manner as a traditional dry stone wall with face stones on both sides sandwiching a core of packed rubble. The stone, donated by a local quarry, is a bluish-gray- and copper-colored mica schist, a metamorphic rock common in the Berkshire region whose flat, slab-like shape makes it ideal for walkways and provides for ease of stacking. The coiled tail of the salamander is flush with the ground and rises gradually to a level of 18" at the body before descending back to the ground at the creature's head. As the local salamander species is spotted, Sendelbach placed buff-colored glaciated quartzite stones within the courses of schist, and used the same for the eyes. The sculpture is built completely dry, and was examined and approved by the local building department.

Owing in part to immediately accessible aesthetics, all natural construction and a nearby preschool, "Crossroads Salamander" has become, in the words of one Amherst official, "an instant focal point" for the park. Like it's distant kin the effigy mounds, it too intends to draw people to its setting. This is especially so amongst children, magnetized by the spiral pathway of the salamander tail. Such drawing power is a testament to the transcendent nature of well-designed and well-wrought stonework -- its ability to stir that portion of the soul containing one's yearnings for a sense of the timeless.

Upon a year of its creation, Amherst residents were solicited for opinions by city officials as to whether the sculpture should be removed as per the original conditions of its installation. The result, according to one of the arts commission members, was an "overwhelming support" to retain the stone salamander as a permanent fixture on the common. Should it endure, its presence could long continue to stimulate imaginations.

John Burnell is a stone masonry contractor in Kent, Ohio.

Back to Table of Contents
Stone Foundation Home Page

TRULLI AMAZING DRY STONE WORK

Todd Campbell


Alberobello

A visit to Europe, especially Italy, is a pilgrimage for a stone mason. My bride and I honeymooned in Italy in March and both found inspiration galore, as she is a chef and restauranteur. I've tried to convince her that there are just two food groups; rock and mortar. Or in more technical terms,"stiff and squishy." To her credit, however, she has pegged the two types of stonework; standing and collapsing.

Ironically, some stone constructs still stand because they're squishy, and some collapse because they're too stiff, but I'm sure these principles apply to food items too, like maybe wedding cakes and souffles. Italian cuisine is diverse and highly realized. So is Italian stonework. Massive Roman buildings like the Pantheon illustrate how successfully, with sound engineering and stone and concrete work, a dome can withstand nearly 2000 years of gound movement and water action. In Florence, the dome atop the Santa Maria del Fiore cathedral, one of the largest masonry domes in the world, was built without centering, bracing, forming, or scaffolding by use of intermittant soldier courses. Thinner than an egg shell relative to its size, bricks set the day previous provided "tooth" and stability for the morrow's building.

Everywhere in Italy, structural stonework is given the dignity and beauty of a sculptor's touch. An American mason who is constantly confronted with requests for "phony stone" (nothing 'cultured' about it) and other veneer applications is shamed by the artisan standards of the Old World, where material costs far exceeded labor costs. As we grow to influence design in our stonework, a nod to fine Italian masonry is nearly a mandate.

In contrast to the amazing works of urban Italy stand the works of Southern Italy's farming communities; huge, guild-sponsored crews of apprenticed masons versus small teams of grape and olive growers. But the same elegance of form and durability prevails. And one of the best examples of graceful, small-scale, dry stack stone construction are the trullo (pl. trulli) buildings in southeastern Italy.

Viewed from afar, trulli look like clusters of white haystacks. Compelling yet simple, the top of each room in a trullo structure is a beehive-shaped dome of dry stacked limestone. This limestone was culled from what would become growing fields, a labor intensive effort which served both purposes. During our honeymoon, we spent several nights at Masseria Grofoleo, bedding down in a reconstructed trullo, and walking around the trulli-stippled communities near Locorotondo and Alberobello. Our host, Lele Fizzarotti, is a prince of a man, theatrical and generous. He never let our glasses of his white wine approach emptiness. His farmhands live on-premises, tending the orchards and the goats and sheep.

A mile away is the hilltop town of Locorotondo, a shimmering dream of bright stone and whitewash bisected by deep and narrow, curving, foot-polished alleyways. Behind its fortifˆied walls emanate the towers and steeples and minarets which are typical of Italian towns. And scattered below for miles around are the trulli, ancient structures built by a peoplewho are not around to elucidate on the how's and why's of their ingenious design. The trullo influence is seen in some buildings in Greece and Africa which are in similiarly arid, rock-rich environs where water collection and conservation is paramount.

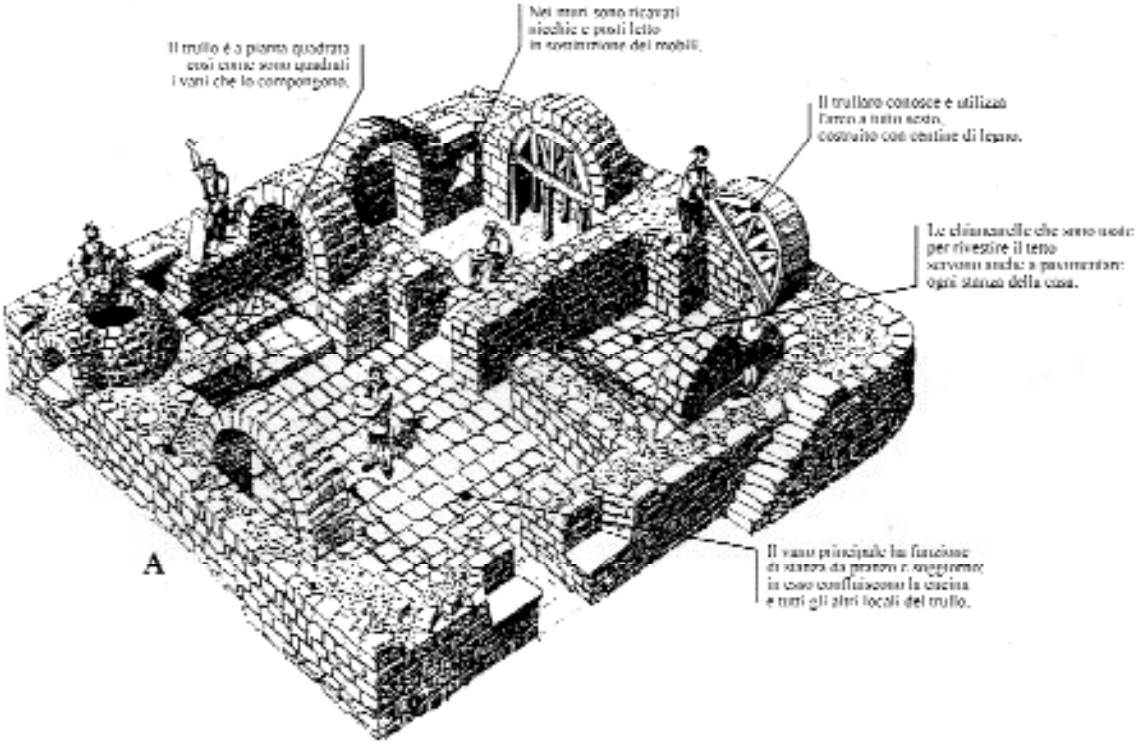
In their design, the trulli show strongly repetitive themes which are explored with a thousand nuances. Foremost is the dome atop each room. The rooms are connected via barrel vault or lintelled passages, and the roofline reflects each passage as a parabolic curve from dome top to dome top. The footprint of each room is roughly square, 9-15 feet per wall length, and at door lintel height, the corners employ "squinches" or corbelling to achieve circularity within one or two courses. Then, it is said, masons built the domes wihout the use of centering or other support. This exceptional claim is true, and with insight, you can see that the masons maximized every advantage with which the long heritage of stone building informed them.

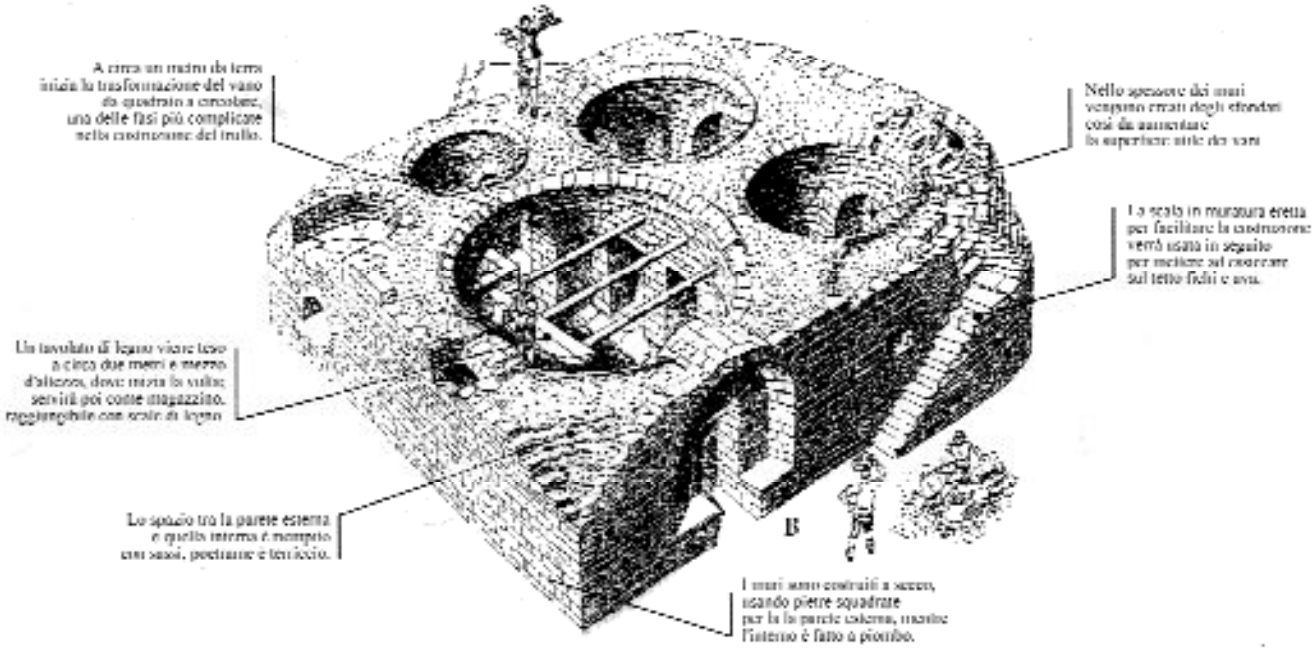
Firstly, the limestone from the fields takes a chisel very nicely. The importance of maintaining surface to surface friction through tight fitting cannot be overemphasized in load bearing dry stack work. A close look at the stones which comprise the dome's outer skin show remarkable workmanship. Each one is slightly radiused with respect to the trullo's central vertical axis, with a slightly tapered top to help shed water. These shingle stones, called chiancarelle, are laid with an outward pitch just a few degrees below level and are uniform to the extent that, though they are dry laid, it is rare to see any missing in even the unrestored trullo. The rocks which comprise the inner skin of the dome are also finely worked. The top of each one leans out farther than the bottom, but this is not achieved by tipping a rectangular stone; each one is shaped so that the joints stay roughly horizontal when laid. Each stone is a true corbel, projecting past the stones below such that the face conforms to the dome's lateral and vertical curves. The dome is 14-20 inches thick and its two skins entomb a lot of rock shims and fill material.

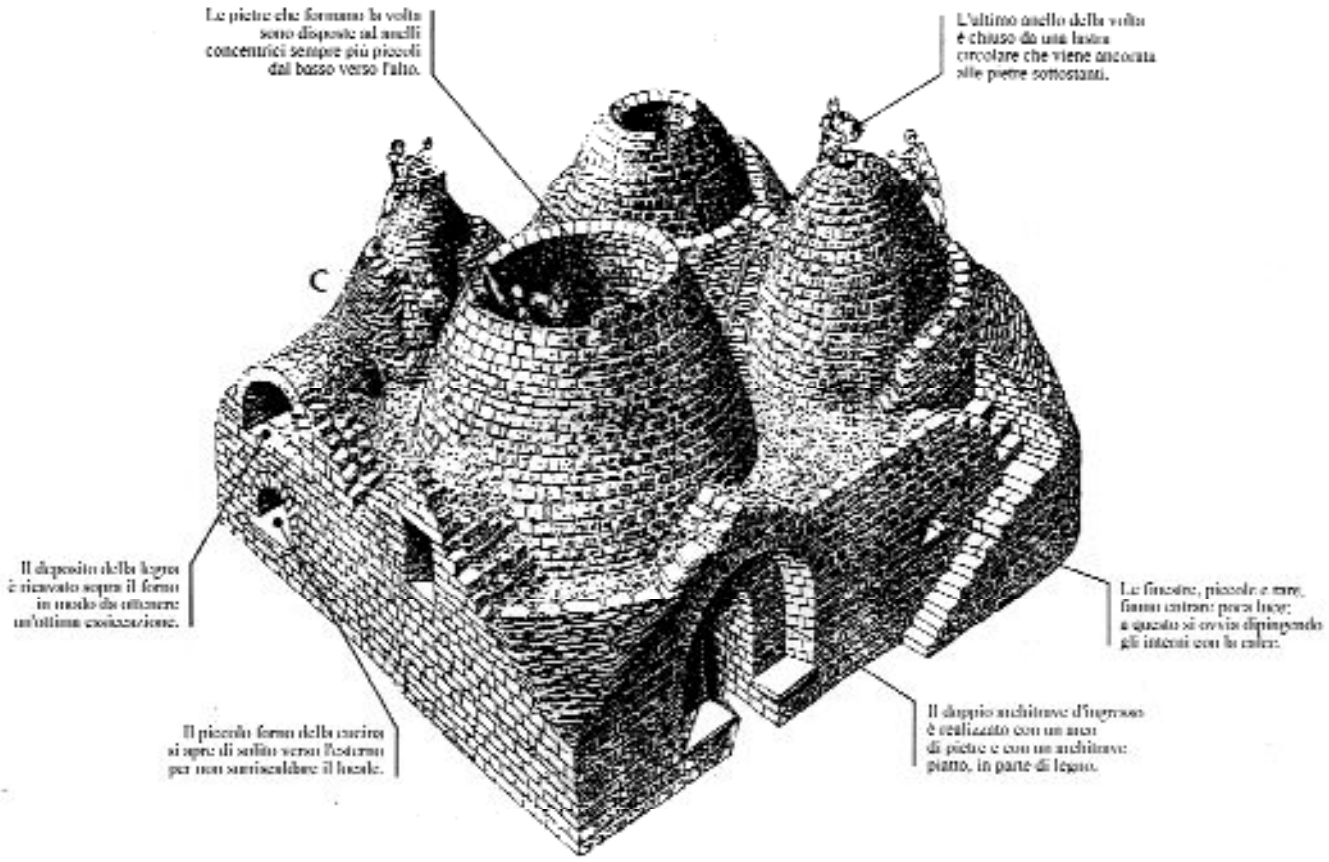
Secondly, the rural masons who built the trulli knew that each course of a dome, once complete and installed, established load bearing integrity called ring tension. It stands to reason that the outer skin was installed immediately after the inner, course by course, so that each top

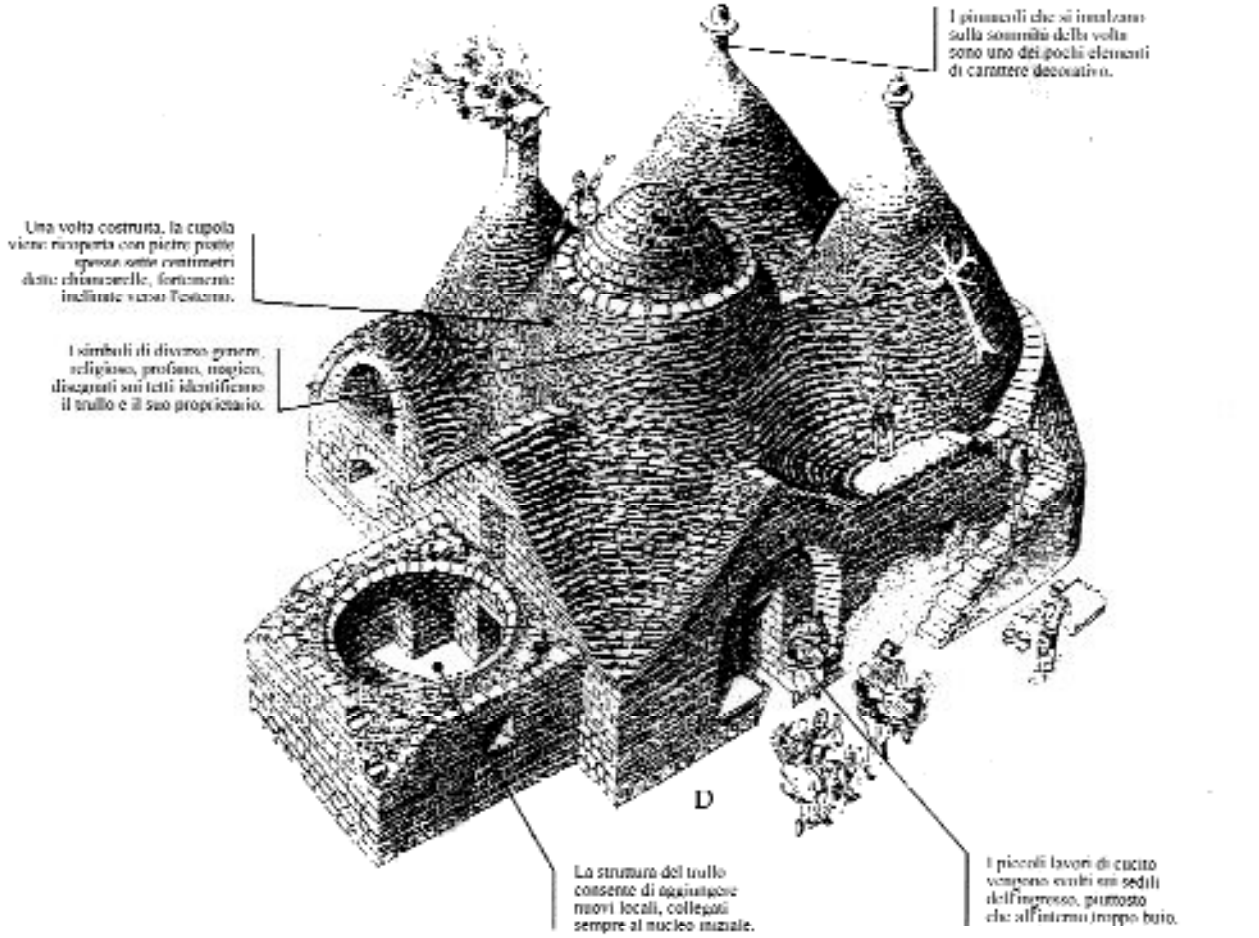
Locorotondo

LE DIVERSE FASI DELLA COSTRUZIONE DI UN TRULLO






Le pietre che formano la volta sono disposte ad anelli concentrici sempre più piccoli dal basso verso l'alto.
L'ultimo anello della volta è chiuso da una lastra circolare che viene ancorata alle pietre sottostanti.
C
Il deposito della legna è ricavato sopra il forno in modo da ottenere un'ottima coibentazione.
Le finestre, piccole e rare, fanno entrare poca luce: a questo si ovvia dipingendo gli interni con la calce.
Il piccolo forno della cucina si apre di solito verso l'esterno per non surriscaldare il locale.
Il doppio architrave d'ingresso è realizzato con un anello di pietre e con un architrave piatto, in parte di legno.


I pinnacoli che si innalzano sulla sommità della volta sono uno dei pochi elementi di carattere decorativo.
Una volta costruita, la cupola viene ricoperta con pietre piatte spesse sette centimetri dette chiancarelle, fortemente inclinate verso l'esterno.
I simboli di diverso genere, religioso, profano, magico, disegnati sui tetti identificano il trullo e il suo proprietario.
D
La struttura del trullo consente di aggiungere nuovi locali, collegati sempre al nucleo iniziale.
I piccoli lavori di cucito vengono svolti sui sedili dell'ingresso, piuttosto che all'interno troppo buio.

course would serve as a narrow scaffolding upon which men could walk and work.

Finally, the profile of the interior of the trullo dome closely resembles a kind of blunt-tipped Gothic arch. The Gothic arch has characteristically near-straight shoulders, which eliminates the forces of horizontal thrust better than other arch profiles, thus increasing its stability as a free-standing form. Perhaps Stone Foundation rÏeaders are familiar with one version of the Utah license plate, which shows Delicate Arch, a massive freestanding stone perched on the rim of a deep canyon. It has that disheveled haystack shape, slightly straight shoulders, and flattish top that is mimicked more symmetrically in trulli. The trullo I measured had the near perfect dimensions of a shape of Gothic arch called an 'a quinto acuto,' which draws each of its arcs from points one-fifth the distance of its horizontal span. In constructing a trullo, the masons fixed a plumb central axis from which to build their rising concentric rings around. However, to create the dome's distinctive inner shape, it is my theory that a cord attached to a rafter roughly one-fifth across the square room became, when pulled taut, the positioning guide for the first rock of each course.

Thus, the arc scribed vertically by this cord established a consistent radius with which to corbel each course of wrought stone. After establishing the position of the first stone of each course, it would then be a matter of constructing a perfect circle around the plumb, central axis.

Every trullo has a roof pitch of 55-60 degrees from horizontal. The walls of the trullo's base are usually more than three feet thick, and they commonly have in-built niches or crude sinks. The thicker-walled base means that a prominent sill supports the dome. Beautifully worked water-channelling stones on this sill direct rainwater to a single drip point, which in turn directs it to an underground cistern via an accessible sink. After looking at dozens of these amazing buildings, I'm sure that this collected water is routed down through the building's drystack walls! The routing was probably made leakproof with plaster, as plaster was also applied to the inside of the dome upon completion of the stone laying. The cistern sits below the trullo, where evaporation is minimized and convenient access is had. This integrated water catchment helped insure survival in an arid land.

Though the white limestone used to build trulli would surely reflect much of the sun's heat, summer days would have been stifling indoors because the only openings in a traditional trullo are the doorway and the chimney shaft. The shaft included no smoke chamber, but a multiple-level chimney exhaust design which probably created enough draft to keep the smoke moving upwards.

It is generally believed that the trulli's inhabitants used its shelter for various domestic and agricultural purposes, but did the bulk of their living out of doors.

Whatever the extent of their daily involvement with these magnificent structures, trulli builders created a durable and beautiful and simple-appearing monument to agrarian harmony. The frosting on the cake, so to speak, was the building's consecration with a carved capstone, or pinnacoli, to finish and bedeck the dome. Shaped differently, to my eye they look like alien church steeple icons, although the most common is a large round stone on a dish-topped pedestal. It is commonly thought that the capstone was believed to ward off evil spirits.

For the most part, these elegant drystacked structures have warded off the evil spirits of erosion and collapse for many many hundreds of years. As my wife would say, "Now, that's food for thought". Trulli amazing.

Todd Campbell is a flintknapper-turned-stonemason contractor from Southern Utah, where nature's abundant rockwork is ever-inspiring.

FONT DEVALL ES PENYAL

aka: the aura laundry village of deia, mallorca, spain

These photographs depict the the restoration of an ancient underground stone vaulted acequia, or water-course. Built by the Moors, possibly as early as the 9th or 10th century, it had collapsed where it emerged at the surface of a retaining wall bordering a public thoroughfare. As is customary in Europe, the repairs were made without attempting to match the material or style of the earlier work - like the earlier work, however, the repair was built without mortar. The stone, freshly quarried limestone, was a joy to work with. It rang like a bell and responded well and truly to the tools. The restoration work was accomplished during [and subsequent to] a stone masonry workshop in 1991. As the workshop director, I was fortunate to be allowed to undertake the project - and to be given the artistic license to take advantage of theconstant and copious flow of water to create a fountain. The setback, a design feature often associated with fountains in the area, enables a person, or persons, to sit and listen to the water sounds [hence the subtitle] and enjoy the view of the village church on its wooded hilltop across the valley.

There is of course more to the story. I had returned to this picturesque village where I previously lived for many years, regarded, rather affectionately, by the villagers as an oddball artist. Reappearing after a long absence and professing to be not only to be a stone mason but a maestro, an instructor of stone masonry was one of the most audacious acts I have ever performed. After all, the island of Mallorca is remarkable for the quality and extent of its stone work, the most skillful examples of which are to be found in Deia and its environs. The local masons surreptitiously inspected the progress of the work but were silent until its completion when, I am happy to report, their approval was bestowed.

Tomas Lipps

RAM(P)SES II

A horrific accident in a steel mill left Charlie Pritts with one eye and the need for a new livelihood. As a boy he had earned pocket money "making " stone at the local quarry-squaring rocks into usable building stone. He had liked that so he decided to become a stone mason.

Charlie, or "Pap" as he was known to all, was my stepmother's father. He had visited one summer and faced my father's fireplace with stone. I helped him on my college summer vacation but wasn't particularly attracted to the work. In part that was because it consisted of gluing up a thin veneer with strips of sandstone (I was studying art and didn't like Mondrian); in part because I considered my other job, as a lifeguard, much more interesting.

But when I returned from a 12 year sojourn in Europe a born-again stone mason I was especially interested, as we were now fellow craftsmen, to see and talk to Pap again. He was then 84 years old but still laying stones on top of stones in southwestern Pennsylvania. He was troubled with arthritis and unless he kept working with his hands they would seize up on him, he said. So during the winter he "made" stone behind his house with which he would build in warmer weather.

In the course of our conversation I asked him how, when he had recovered from his accident, he had gotten started in his newly chosen line of work. Did he take work with a experienced stone mason? Consult books? "Nope, I just bought a bunch of rock and built me a house so folks in town would see what I could do. Built it all by myself. Took a whole summer and some of the fall."

I was familiar with the house that he and his family had lived in for years. Two stories with an attic and a basement. A stone fireplace and chimney. And well built, especially for a novice. Quite an undertaking, even for a small crew, and Pap, without experience, had done it alone? In four or five or even six months? My own experience with stone building made me incredulous.

"C'mon, Pap, just you? No laborers even? No one to haul stone and mortar up to you?"

"Just little ol' me" (Pap wasn't a big man).

"O.K., Pap, if you say so, I believe you. But tell me, how DID you get materials up to where they were needed?"

"Real simple, I just ramped around it. Built as I ramped. Ramped as I built."

"Why, Pap, that's how they think the Egyptians built the pyramids!"

Pap's one eye twinkled. "Well, them E–gyptians wasn't so dumb then, was they?"

No, Pap, in some ways they were as smart as you.

Tomas Lipps

THE MASON

CARL MURRAY BATES

We're in a tavern no more than thirty yards from the banks of the Ohio. Toward the far side of the river, Alcoa smokestacks belch forth: an uneasy coupling of a bucolic past and an industrial present. The waters are polluted, yet the jobs out there offer the townspeople their daily bread.

He is fifty-seven years old. He's a stonemason who has pursued his craft since he was seventeen. None of his three sons is in his trade.

As far as I know, masonry is older than carpentry, which goes clear back to Bible times. Stone mason goes back way *before* Bible time: the pyramids of Egypt, things of that sort. Anybody that starts to build anything, stone, rock, or brick, start on the northeast corner. Because when they built King Solomon's Temple, they started on the northeast corner. To this day, you look at your courthouses, your big public buildings, you look at the cornerstone, when it was created, what year, it will be on the northeast corner. If I was gonna build a septic tank, I would start on the northeast corner. (Laughs.) Superstition, I suppose.

With stone we build just about anything. Stone is the oldest and best building material that ever was. Stone was being used even by the cavemen that put it together with mud. They built out of stone before they even used logs. He got him a cave, he built stone across the front. And he learned to use dirt, mud, to make the stones lay there without sliding around—which was the beginnings of mortar, which we still call mud. The Romans used mortar that's almost as good as we have today.

Everyone hears these things, they just don't remember 'em. But me

From WORKING by Studs Terkel
Reprinted by permission of Donadio & Olson, Inc.

being in the profession, when I hear something in that line, I remember it. Stone's my business. I, oh, sometimes talk to architects and engineers that have made a study and I pick up the stuff here and there.

Every piece of stone you pick up is different, the grain's a little different and this and that. It'll split one way and break the other. You pick up your stone and look at it and make an educated guess. It's a pretty good day layin' stone or brick. Not tiring. Anything you like to do isn't tiresome. It's hard work; stone is heavy. At the same time, you get interested in what you're doing and you usually fight the clock the other way. You're not lookin' for quittin'. You're wondering you haven't got enough done and it's almost quittin' time. (Laughs.) I ask the hod carrier what time it is and he says two thirty. I say, "Oh, my Lord, I was gonna get a whole lot more than this."

I pretty well work by myself. On houses, usually just one works. I've got the hod carrier there, but most of the time I talk to myself, "I'll get my hammer and I'll knock the chip off there." (Laughs.) A good hod carrier is half your day. He won't work as hard as a poor one. He knows what to do and make every move count makin' the mortar. It has to be so much water, so much sand. His skill is to see that you don't run out of anything. The hod carrier, he's above the laborer. He has a certain amount of prestige.

I think a laborer feels that he's the low man. Not so much that he works with his hands, it's that he's at the bottom of the scale. He always wants to get up to a skilled trade. Of course he'd make more money. The main thing is the common laborer—even the word *common* laborer—just sounds so common, he's at the bottom. Many that works with his hands takes pride in his work.

I get a lot of phone calls when I get home: how about showin' me how and I'll do it myself? I always wind up doin' it for 'em. (Laughs.) So I take a lot of pride in it and I do get, oh, I'd say, a lot of praise or whatever you want to call it. I don't suppose anybody, however much he's recognized, wouldn't like to be recognized a little more. I think I'm pretty well recognized.

One of my sons is an accountant and the other two are bankers. They're mathematicians, I suppose you'd call 'em that. Air-conditioned offices and all that. They always look at the house I build. They stop by and see me when I'm aworkin'. Always want me to come down and fix somethin' on their house, too. (Laughs.) They don't buy a house that I don't have to look at it first. Oh sure, I've got to crawl under it and look on the roof, you know . . .

I can't seem to think of any young masons. So many of 'em before, the man lays stone and his son follows his footsteps. Right now the only one of these sons I can think of is about forty, fifty years old.

I started back in the Depression times when there wasn't any apprenticeships. You just go out and if you could hold your job, that's it. I was just

a kid then. Now I worked real hard and carried all the blocks I could. Then I'd get my trowel and I'd lay one or two. The second day the boss told me: I think you could lay enough blocks to earn your wages. So I guess I had only one day of apprenticeship. Usually it takes about three years of being a hod carrier to start. And it takes another ten or fifteen years to learn the skill.

I admired the men that we had at that time that were stonemasons. They knew their trade. So naturally I tried to pattern after them. There's been very little change in the work. Stone is still stone, mortar is still the same as it was fifty years ago. The style of stone has changed a little. We use a lot more, we call it golf. A stone as big as a baseball up to as big as a basketball. Just round balls and whatnot. We just fit 'em in the wall that way.

Automation has tried to get in the bricklayer. Set 'em with a crane. I've seen several put up that way. But you've always got in-between the windows and this and that. It just doesn't seem to pan out. We do have a power saw. We do have an electric power mix to mix the mortar, but the rest of it's done by hand as it always was.

In the old days they all seemed to want it cut out and smoothed. It's harder now because you have no way to use your tools. You have no way to use a string, you have no way to use a level or a plumb. You just have to look at it because it's so rough and many irregularities. You have to just back up and look at it.

All construction, there's always a certain amount of injuries. A scaffold will break and so on. But practically no real danger. All I ever did do was work on houses, so we don't get up very high—maybe two stories. Very seldom that any more. Most of 'em are one story. And so many of 'em use stone for a trim. They may go up four, five feet and then paneling or something. There's a lot of skinned fingers or you hit your finger with a hammer. Practically all stone is worked with hammers and chisels. I wouldn't call it dangerous at all.

Stone's my life. I daydream all the time, most times it's on stone. Oh, I'm gonna build me a stone cabin down on the Green River. I'm gonna build stone cabinets in the kitchen. That stone door's gonna be awful heavy and I don't know how to attach the hinges. I've got to figure out how to make a stone roof. That's the kind of thing. All my dreams, it seems like it's got to have a piece of rock mixed in it.

If I got some problem that's bothering me, I'll actually wake up in the night and think of it. I'll sit at the table and get a pencil and paper and go over it, makin' marks on paper or drawin' or however . . . this way or that way. Now I've got to work this and I've only got so much. Or they decided they want it that way when you already got it fixed this way. Anyone hates tearing his work down. It's all the same price but you still don't like to do it.

These fireplaces, you've got to figure how they'll throw out heat, the

way you curve the fireboxes inside. You have to draw a line so they reflect heat. But if you throw out too much of a curve, you'll have them smoke. People in these fine houses don't want a puff of smoke coming out of the house.

The architect draws the picture and the plans, and the draftsman and the engineer, they help him. They figure the strength and so on. But when it comes to actually makin' the curves and doin' the work, you've got to do it with your hands. It comes right back to your hands.

When you get into stone, you're gettin' away from the prefabs, you're gettin' into the better homes. Usually at this day and age they'll start into sixty to seventy thousand and run up to about half a million. We've got one goin' now that's mighty close, three or four hundred thousand. That type of house is what we build.

The lumber is not near as good as it used to be. We have better fabricating material, such as plywood and sheet rock and things of that sort, but the lumber itself is definitely inferior. Thirty, forty years ago a house was almost entirely made of lumber, wood floors . . . Now they have vinyl, they have carpet, everything, and so on. The framework wood is getting to be of very poor quality.

But stone is still stone and the bricks are actually more uniform than they used to be. Originally they took a clay bank . . . I know a church been built that way. Went right on location, dug a hole in the ground and formed bricks with their hands. They made the bricks that built the building on the spot.

Now we've got modern kilns, modern heat, the temperature don't vary. They got better bricks now than they used to have. We've got machines that make brick, so they're made true. Where they used to, they were pretty rough. I'm buildin' a big fireplace now out of old brick. They run wide, long, and it's a headache. I've been two weeks on that one fireplace.

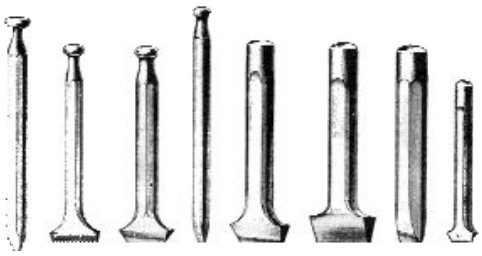
The toughest job I ever done was this house, a hundred years old plus. The lady wanted one room left just that way. And this doorway had to be closed. It had deteriorated and weathered for over a hundred years. The bricks was made out of broken pieces, none of 'em were straight. If you lay 'em crooked, it gets awful hard right there. You spend a lifetime tryin' to learn to lay bricks straight. And it took a half-day to measure with a spoon, to try to get the mortar to match. I'd have so much dirt, so much soot, so much lime, so when I got the recipe right I could make it in bigger quantity. Then I made it with a coffee cup. Half a cup of this, half a cup of that . . . I even used soot out of a chimney and sweepin's off the floor. I was two days layin' up a little doorway, mixin' the mortar and all. The boss told the lady it couldn't be done. I said, "Give me the time, I believe I can do it." I defy you to find where that door is right now. That's the best job I ever done.

There's not a house in this country that I haven't built that I don't look

at every time I go by. (Laughs.) I can set here now and actually in my mind see so many that you wouldn't believe. If there's one stone in there crooked, I know where it's at and I'll never forget it. Maybe thirty years, I'll know a place where I should have took that stone out and redone it but I didn't. I still notice it. The people who live there might not notice it, but I notice it. I never pass that house that I don't think of it. I've got one house in mind right now. (Laughs.) That's the work of my hands. 'Cause you see, stone, you don't prepaint it, you don't camouflage it. It's there, just like I left it forty years ago.

I can't imagine a job where you go home and maybe go by a year later and you don't know what you've done. My work, I can see what I did the first day I started. All my work is set right out there in the open and I can look at it as I go by. It's something I can see the rest of my life. Forty years ago, the first blocks I ever laid in my life, when I was seventeen years old. I never go through Eureka—a little town down there on the river that I don't look thataway. It's always there.

Immortality as far as we're concerned. Nothin' in this world lasts forever, but did you know that stone—Bedford limestone, they claim—deteriorates one-sixteenth of an inch every hundred years? And it's around four or five inches for a house. So that's gettin' awful close. (Laughs.)



INTERNATIONAL LIBRARY OF TECHNOLOGY

A SERIES OF TEXTBOOKS FOR PERSONS ENGAGED IN THE ENGINEERING PROFESSIONS AND TRADES OR FOR THOSE WHO DESIRE INFORMATION CONCERNING THEM FULLY ILLUSTRATED AND CONTAINING NUMEROUS PRACTICAL EXAMPLES AND THEIR SOLUTIONS

MASONRY

CARPENTRY

JOINERY

STONE ARCHES.

87. Stone arches are generally used in both stone and brick structures, over door and window openings, for porches, etc. They are also erected over streams and roads for highway and railway bridges and aqueducts. Stone arches of long span are not as frequently built now as formerly, iron and steel having been very largely substituted for stone. In some ways, a stone arch is not as satisfactory as a brick one. Being composed of a few large pieces, instead of many small ones—as is a brick arch—the bond is not so perfect; and consequently, of the two, the stone arch is somewhat more liable to settle and crack.

The amount of masonry in heavy piers, etc., can, without injuring the stability of the structure, often be considerably diminished by the use of arches, provided the stone and the footings are capable of carrying the increased load. The pressure on the soil may, if necessary, be decreased by using inverted arches. (See Arts. **91 95,** *Masonry*, §7.)

88. The principal parts of an arch are as follows: The *abutments* are the piers from which the arch springs, as at

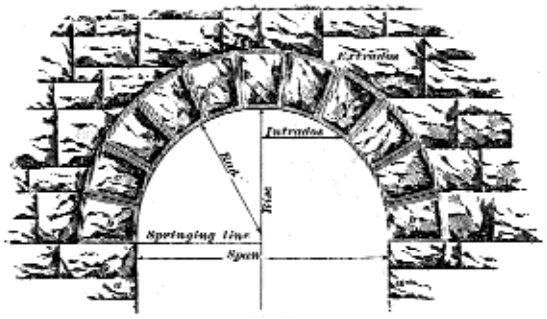


FIG. 48.

a, Fig. 48. The inner edge of the top of the abutment is called the *springing line;* the stones resting on the abutments, shown at *b*, are called *skewbacks*. The arch itself consists of wedge-shaped stones, called *voussoirs*, or *ring stones*. These are sometimes of varying sizes, but for the same arch are generally made as nearly uniform as possible; the depth (back into the wall), however, may vary as much as may be necessary for proper bonding. The voussoirs are shown at *c*. The ring stones between the keystone and the skewbacks are collectively known as the *haunches* of the arch. The masonry resting on the arch ring, from the piers to a horizontal line touching the highest point of the upper curve, form the *spandrels*. The under surface of the arch is called the *soffit*, and a line representing the curve of the soffit is the *intrados;* the one parallel to it at the outer end of the voussoirs is called the *extrados*. The *span* of an arch is the distance between the abutments; and the *rise* is the extreme vertical height from the springing line to the intrados.

89. In building construction, it is not customary to determine the proportions of arches of small span by calculation. The appearance is often the controlling factor in designing such arches. But when the arches are of considerable span, the position of the *line of resistance* should be determined. As that is somewhat beyond the scope of this section, merely the conditions necessary for stability will be here mentioned.

In relation to arches for engineering purposes, the well known authority, Professor Rankine, says: "The best course in practice is to assume a depth for the keystone based on the dimensions of good existing examples." This statement holds good in connection with the construction of the arches which an architect ordinarily has to design.

90. Having fixed the depth of the keystone, the voussoirs are all made the same height, in arches of small span, while in longer ones the ring stones vary in depth, increasing gradually from the crown to the skewbacks, so as to preserve a uniform pressure on the stones as the load becomes greater. The resistance to crushing of any kind of stone may be readily determined, and a large margin of safety must be allowed over the greatest pressure to which it will be subjected in the arch.

91. To insure the stability of an arch, there are two conditions, besides the one just mentioned, which must be satisfied. One is that the pressure shall not cause the opening of the joints; the other, that the direction of the pressure shall not be such as to cause one ring stone to slide on another.

In order to prevent rotation on the edge of any stone, the line of pressure through which the load is assumed to act—must not be above or below the arch ring at any point, but must cut the abutting surfaces of the stones as near as possible to the center of the joint, and always within the middle third of the arch, so as to prevent the opening of the joints. To obviate the liability of sliding at any joint, the pressure tending to move one stone on another must not be sufficient, nor in such direction as to overcome the friction between the surfaces.

These requirements are met by making the arch ring of proper depth, and generally do not need to be determined theoretically for small arches.

92. Flat arches—those having but little rise—give way by breaking the four parts, opening at the crown of the intrados and at some joint on the extrados. When a flat arch breaks, the two upper parts fall inwards and press the lower parts outwards. In pointed arches, the reverse is the case, the lower portions tending to fall into the opening, and to force the upper parts outwards.

KINDS OF ARCHES.

93. Arches are frequently named from the curve of the intrados, as *semicircular*, *segmental*, *semielliptic*, *pointed*, etc. The *semicircular* arch is, as its name indicates, one whose intrados is a half circle. The *segmental* arch is one in which the intrados is generally an arc of large radius, less than a semicircle. Sometimes the curve is composed of arcs of two or three different radii, in which case it is termed a *three* or *five centered* arch. The upper part of such an arch has a long radius, while the portions near the springing line have short and equal radii. This arch is nearly elliptic in form, and is often so known. The true ellipse is also used, an example being given in Fig. 55. Examples of segmental and three centered arches are given under the heading "Brick Arches," *Masonry*, §7. The *pointed* arch has its intrados formed of two arcs of equal radius, intersecting at the crown. The *equilateral* pointed arch is one in which the radii of the intrados are equal to the span, as shown in Fig. 51. There are numerous other forms of arches, but it is unnecessary to describe them all, on account of the general similarity between them and those already mentioned.

When the springing line of an arch is below the center, as shown in Fig. 48, the arch is said to be *stilted*, the distance from center to springing line being the *stilt*.

94. A stone arch frequently built is the one shown in Fig. 48. In this case the arch ring is of equal depth all around, and the voussoirs are all of the same size; the dressing is rock faced with pitched joints. Sometimes the voussoirs have a margin draft, as shown on *b* and *c*.

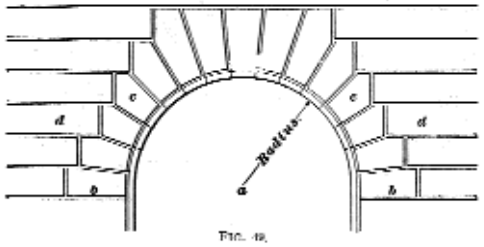


FIG. 49.

95. Arches that are used in coursed ashlar are often built as shown in Figs. 49 and 50. In each of these, *a* is

the center of the arch; *b, b*, the springing line; *c, c*, the ring stones; and *d, d*, the coursed stonework. Arches of this description are more expensive to execute than those in

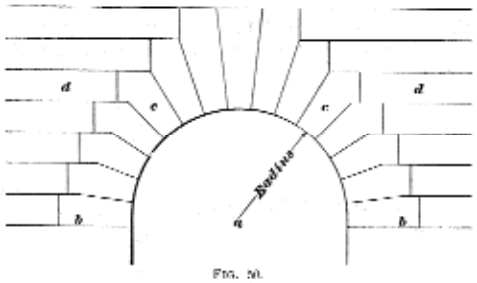


Fig. 50.

which the intrados and extrados are concentric, on account of the greater number of patterns required, the increased quantity of stone needed, and the work necessary to properly dress the voussoirs.

96. Fig. 51 gives an example of a *Gothic*, or pointed equilateral arch, with the intrados and extrados concentric.

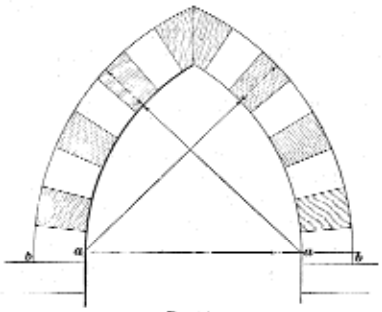


Fig. 51.

In this illustration, *a, a* are the centers from which the arch is struck, and *b, b* is the springing line.

97. Fig. 52 shows an arch having the intrados semicircular and the extrados pointed. Such arches are found in Venice, and are sometimes termed *Venetian Gothic* arches. At *a* is the center for the semicircular intrados; at *b, b* are the centers for the extrados, or pointed arch; and at *c, c* is the springing line.

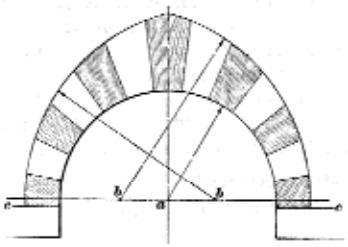


Fig. 52.

98. The *horseshoe*, or *Moorish*, arch is represented in Fig. 53. The Alhambra, at Granada, Spain, has some of

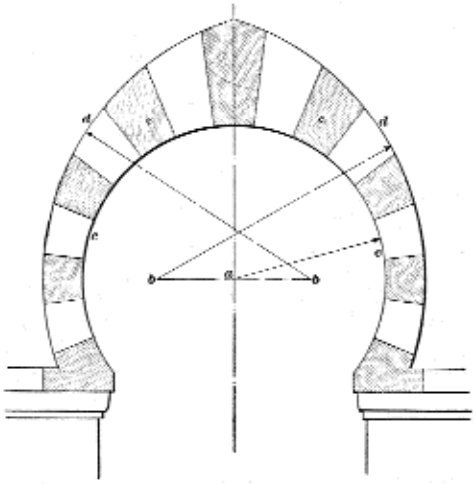


Fig. 53.

the best examples of this arch. Sometimes it is built with the intrados and extrados concentric, and also with the intrados having a horseshoe form, and the extrados a pointed form. The example given shows the latter method of construction. At *a* is shown the center for the horseshoe intrados; at *b, b* are the centers for the pointed extrados of the arch; *c* indicates the soffit of the horseshoe arch; *d*, the upper side of the arch ring; and *e*, the voussoirs. In all horseshoe arches the center is stilted far above the springing lines, to produce the required effect.

99. Arches having an elliptical or oval form, or pointed in the center and elliptical near the springing joints, are often used in architectural work. These may be formed either of true elliptic curves, or of 3 or 5 centered circular arcs. Very flat elliptical arches are not suitable for any considerable span, and, if built, should have large piers or abutments; or beams may be placed above the arch, to relieve it of some of the load.

The method of finding the direction of the joints in a false elliptical arch is shown in Fig. 54. The construction of the

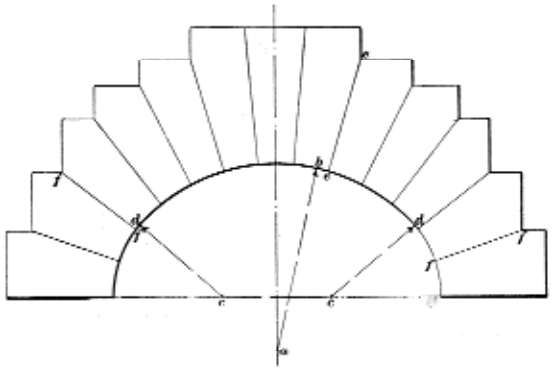


Fig. 54.

ellipse is similar to that given under the heading, "Inverted Arches," *Masonry*, § 7. The radius for the middle of the arch is *a b*; the radii for the two haunches are the lines *c d*.

The joints of the voussoirs in the central portion are drawn with *a* as a center, as at *e e*, etc.; and the joints for the haunches are drawn with *c, c* as centers, as at *f f*, etc.

100. A method of finding the voussoir joints in a true elliptical arch is given in Fig. 55. This shows d^1, d^2, d^3, d^4,

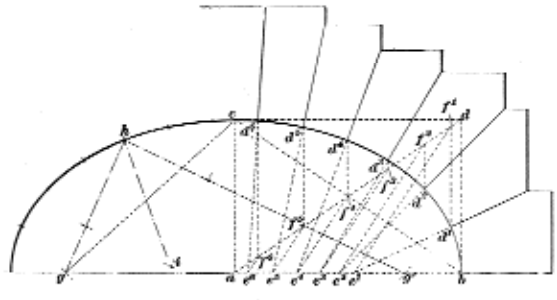


Fig. 55.

d^5, and d^6 as the points through which it is desired to draw the joints. Draw tangents to the ellipse at the points *b* and *c*, intersecting at *d*; also, the lines *a d* and *b c*; draw from d^1, d^2, d^3, etc., lines intersecting *a d* at f^1, f^2, f^3, etc. From these points, draw lines perpendicular to *b c* intersecting *a b* at e^1, e^2, e^3, etc.; then lines drawn through $e^1 d^1$, $e^2 d^2$, etc. will be normal to the curve and give the required joints.

Another and simpler method to find the direction of the joints is as follows: Find the foci of the ellipse by striking arcs from *c* with *a b* as a radius, cutting the major axis at *g* and *g'*. Let *h* be the point where the direction of the joint is to be found. Draw *g h* and *g' h*, and bisect the angle *g h g'*, as at *h i*; then *h i* is the direction of the joint at *h*.

101. The flat arch is very common in architecture, but is not a strong construction. To be self-supporting it must

be of such a size that a segmental arch of proper radius and sufficient depth can be drawn on its face, as shown in Fig. 56 by the dotted lines *a*, *a*. This arch should have a radius equal to the width of the opening—which in this case is 4 feet—while the limiting width for an arch of this description should not be over 5 feet. The keystone should

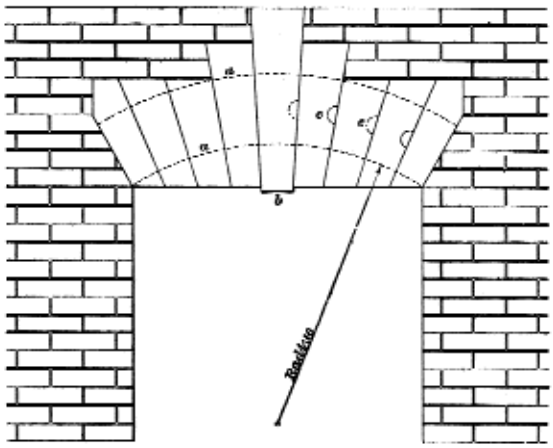


FIG. 56.

project about an inch below the soffit of the arch, as indicated at *b*, in order to more tightly wedge together the voussoirs. The strength of this arch may be increased by notching one stone into the next, as shown at *c*, *c*; or dowel-pins are sometimes used to bind the stone together.

102. When an arch is so flat as to have practically no rise, it should be cut out of one piece of stone, being really a solid lintel with false joints cut on its face, as shown at *a*, *a*, Fig. 57. The ends of this lintel should have a bearing on the wall of 4 or 5 inches, as indicated by the dotted lines at *b*, *b*. If the walls are of brick, about 2 inches of the front of the stone may be cut away and faced with brick.

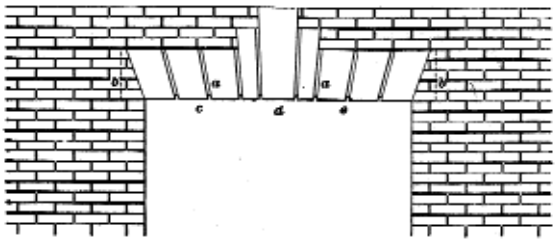


FIG. 57.

If this method is too costly, the lintel may be cut in 3 pieces, as shown at *c*, *d*, and *e*, and supported by a heavy angle bar, as described under "Lintels."

103. Rubble Arches.—For rough purposes, arches are sometimes built of rubble, as shown in Fig. 58, in which *b* represents the wall carried by the rubble arch, the ring stones of which, as *a*, should be narrow and roughly dressed

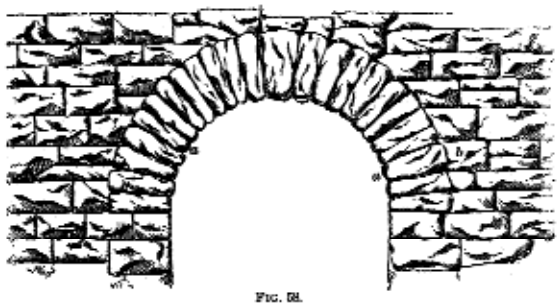


FIG. 58.

to a wedge shape. Such arches should always be laid in cement mortar, as they depend considerably upon the adhesive power of the mortar for their stability.

104. Voussoirs. The ring of the arch should be built of the very best kind of ashlar masonry, cut, so that the voussoirs bear evenly and closely against one another, with the thinnest possible joints, as it is desirable to have but little mortar between the stones. The width of the ring stones is seldom less than 1 foot, or more than 2 feet, and the thickness (back into the wall) varies from 1 to 3 feet. The joints of the stonework should be the same width throughout the arch, so that the bearing may be uniform over the entire surface. The thickness of the joints depends somewhat upon the character of the finish. If the work is finely dressed, $\frac{1}{16}$ inch is the usual thickness; while in rock-faced work it is seldom made less than $\frac{1}{8}$ inch; $\frac{1}{4}$ inch is all that is usually allowed for the best work.

105. Usually the arch is divided into an odd number of voussoirs, and the keystone is placed in position last. Except for the convenience of the masons in laying, and for the sake of appearance, there seems to be no special reason for an uneven number of voussoirs, and some authorities claim that an even number makes a better job. Narrow voussoirs, while more economical in the amount of material used, are more expensive in labor, as more cutting and fitting is required than with wider ones.

Sometimes two of the voussoirs are cut from one stone, with a false joint between. Although this is generally done for economy, there are cases when the stability of the arch is thereby increased; as, for example, when the skewbacks are made twice the size of the remaining voussoirs, the number of joints is decreased, thus tending to strengthen the arch. In the case of a pointed arch, as shown in Fig. 52, the keystone should be made in two pieces, as the danger of its cracking or slipping is very much lessened when this is done.

106. Backing.—As a rule the cut-stone arches in buildings are only from 6 to 8 inches thick, having a backing of a less costly kind of stonework. Large arches, especially when both sides are visible, as in some entrances, porches, etc., are often constructed as shown in Fig. 61. In this case, the stone ashlar is backed with brick, and tied together with clamps, as indicated at *f*.

107. Beams and Tie-Rods.—When an arch is to be built in a position where sufficient abutments to resist the arch thrust cannot be provided, one or more steel beams should be laid on the wall immediately over the arch, with the ends resting on the masonry forming the abutments. Anchor rods, securely embedded, should be used to tie together the beams and the stonework. Immediately below the middle of the beam, a small space, or joint, without mortar, should be left, so that if the beams deflect under the load they will not rest upon the arch. This method relieves the abutments of the arch thrust due to the load, which is, instead, transmitted vertically to the supports.

In building a segmental arch it is a good precaution, if conditions permit, to tie the arch together with steel rods, to take up the thrust until the mortar in the masonry has thoroughly set.

108. Bonding.—Whenever arches are carried on piers or columns, care must be taken in cutting the springing

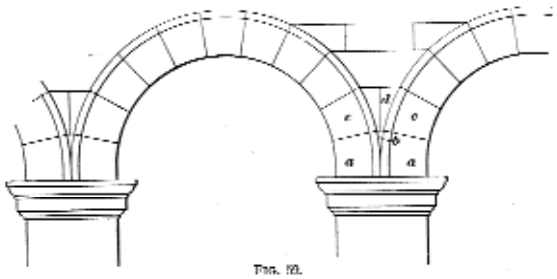


FIG. 59.

stones, so that they will bond properly into the spandrel masonry. In Fig. 59 are shown two arches springing from a pier; if the stones *a* are so cut that the wedge shaped piece

b is necessary to fill up the space between them, there is danger that the weight of masonry over *b* will force it down, displacing the springing stones *a*; and similarly with the stones *c*. To prevent this, the stones *a* should be cut in one piece, while those marked *c* should be cut so as to make the joint come at *d*.

A somewhat similar case is represented in Fig. 60. Here the back of the arch extends almost to the corner of the wall, as shown at *b*. It is evident that, if the brick wall

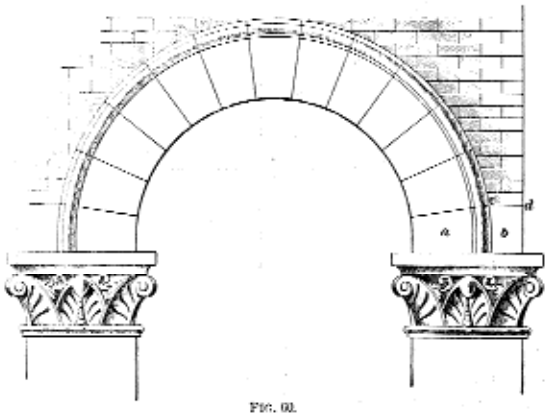


FIG. 60.

rests on such a small footing, it is liable to separate from the arch, thrusting out of place some of the lower bricks. In such a case, the lower voussoir *a* should be cut so as to extend to the corner of the wall, until the distance *c d* is at least 8 inches; more than this should be allowed if the wall is very heavy.

109. Molding.—Arches are often decorated with more or less elaborately dressed stone, known as *label* and *soffit* moldings. The former is sometimes cut in the ring stones, but oftener forms a separate course of thin stone. If such is the case, the stability of the arch should not depend on the strength of the stone in the molding.

The soffit molding is frequently in the form of a bead and cone, or three-quarter round and cone, or some similar shape. Entrance arches are often decorated with various devices cut in the soffits, especially in entrances to cathedrals, public and office buildings, etc.

In Fig. 61, the label mold is shown at *a*; the arch rings,

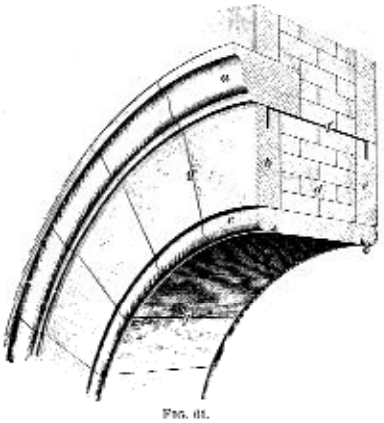


FIG. 61.

at *b* and *c*; the soffit mold, at *e*; the brick backing, or filling, at *d*; and the voussoir joints, at *g*. Every alternate pair of voussoirs should be tied together with galvanized iron clamps doweled into the stones, as shown at *f*.

110. Centers.—In building an arch, it is carried up from both piers or abutments at the same time. During construction, the stones must be supported until the ring is completed. For this purpose, a framework, made of planks having one side cut to exactly fit the curve of the arch, is used. This framing, known as a *center*, is supported on posts; it is usual to insert wedges between the center framing and the posts supporting it, which, when the arch is completed and the mortar has set, are driven out gradually, so as to bring the load on the arch ring without shock. The center should be strong enough to support the weight of the arch and a share of the wall above, as no weight should be put on the arch until the mortar in the joints has become hard.

111. Fig. 62 represents a form of center suitable for arches of small span. At *a* are shown the *bearers*, which

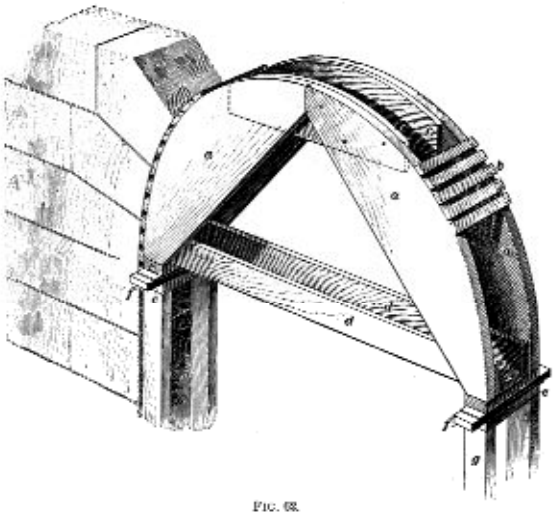


FIG. 62.

are cut out of 2-inch plank, to a radius about 1 inch less than that of the intrados of the arch. At *c* are indicated pieces of plank, nailed at the crown of the center to splice and stiffen it. Small bearing strips *b*, about 1 in. × 2 in. in section, are nailed to the curved pieces *a*. At *d* are the longitudinal braces; at *e* are the plates under the center and on top of the posts; at *f* are the wedges; and at *g*, the posts, which, if quite long, should be braced at the middle by struts.

112. For arches of considerable span, centers more strongly built are necessary. Fig. 63 shows a good form of construction. At *a* and *b* are represented the bearers, break-

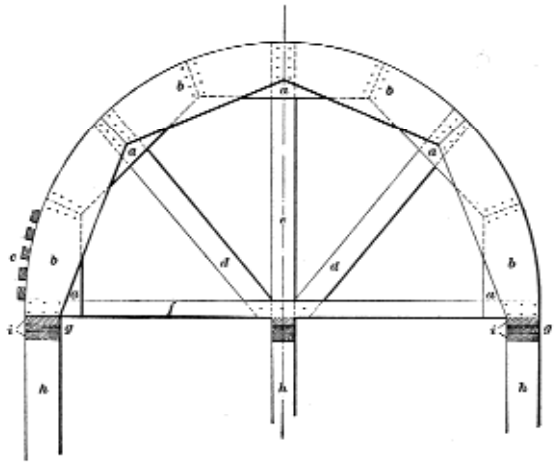


FIG. 63.

ing joint as shown; *c* indicates the bearing strips; *e*, the upright; *d*, the inclined braces; *f*, the tie piece; *i*, the bearing plates, with wedges *g* between; and *h*, the side and center posts.

excerpt from a stone mason's journal

"Sixty stories up, in a world few others ever see, masons are cutting stone.

Far below lies the hustle and bustle of the city; yet up here it is so very quiet. There are actually falcons that make their aeries up here; and drift lazily on updrafts between the mountains of stone.

Hanging at sixty stories up in the canyons of Manhattan is like climbing in Monument Valley and Brice canyon. It can be quiet all day with just the sounds of hammer and chisel and then, as the 11 o'clock sun passes the stainless eagles of Chrysler Building you hear distinct H A L LO s resonating in the distance.

You search the roof tops below...nothing...then, more H A L L O s, only closer by. Then, peering, you see just off to your right about 5 buildings distant. another group of masons on the Hemsley building riding a scaffold not unlike yours. You wave hammers and they respond likewise...and then you are startled by yet another set of H A L L O s just off to the left and slightly downward where you see another group of masons „riding rig" with raised hammers on the Linclon building.

Like climbers we share a small private world; our environment resonates with the rhythm of hammer and chisel on stone We know each other by certain signs. To outsiders it seems we talk in tongues; we share the dust and blood of an ancient craft."

Michael Davidson 2001
Michael (msguild@aol.com) is a member of the Stone Foundation
as well as the Stone Guild, a group of cathedral masons.

OH, LOVELY ROCK

We stayed the night in the pathless gorge of Ventana Creek,
up in the east fork.
The rock walls and the mountain ridges hung forest on forest
above our heads, maple and redwood,
Laurel, oak, madrone, up to the high and slender Santa Lucian
firs that stare up the cataracts
Of slid-rock to the star-color precipices.

We lay on gravel and
kept a little camp-fire for warmth.
Past midnight only two or three coals glowed red in the cooling
darkness; I laid a clutch of dead bay leaves
On the ember ends and felted dry sticks across them and lay
down again. The revived flame
Lighted my sleeping son's face and his companion's and the
vertical face of the great gorge wall
Across the stream. Light leaves overhead danced in the fire's
breath, tree trunks were seen: it was the rock wall
That fascinated my eyes and mind. Nothing strange: light-gray
diorite with two or three slanting seams in it,
Smooth polished by the endless attrition of slides and floods; no
fern or lichen, pure naked rock . . . as if I were
seeing rock for the first time. as if I were seeing through the
flame-lit surface into the real and bodily
And living rock. Nothing strange . . . I cannot
Tell you how strange: the silent passion, the deep nobility and
childlike lovliness: this fate going on
Outside our fates. It is here in the mountain like a grave smiling
child. I shall die and my boys
Will live and die, our world will go on through it's rapid agonies
of change and discovery; this age will die,
And wolves have howled in the snow around a new Bethlehem:
this rock will be here grave, earnest, not passive: the energies
That are its atoms will still be bearing the whole mountain above:
and I, many packed centuries ago,
Felt its intense reality with love and wonder, this lonely rock.

Robinson Jeffers 1962

September 17-21, 2001

STONE CARVING WORKSHOP

A stone carving workshop will be held at Southwest Stoneworks in Rinconada, New Mexico (between Santa Fe and Taos) the week of September 17-21. The class will be conducted by British master stone carver, Patrick Plunkett a former lead stone carver at the National Cathedral in Washington DC.

Topics will include: tool selection, sharpening and care; stone selection; model making; transferring measurements to the stone; carving with hand and pneumatic tools; and finishing techniques. The class will be suitable for beginning and advanced carvers

contact Mark Saxe: tel (505 579-9179 (day), (505) 689-2333 (evening), fax (505) 689-1009.

October, 2001

SPAIN - A STONEWORK STUDY TOUR

The Stone Foundation offers a guided tour of the remarkable well-wrought stonework of the picturesque Balearic Islands of Mallorca and Minorca off the eastern coast of Spain. 4,000 years of history are represented by examples of fine stonework from Megalithic, Roman, Moorish, Medieval and more recent eras. The tour will culminate in Barcelona with a survey of the work of the Catalan architect, Antoni Gaudi as well as other interesting sites there. Good Mediterranean food, wine and camaraderie.

For information visit www.stonefoundation.org or write to The StoneFoundation, 116 Lovato Lane, Santa Fe, NM 87505

October 26-28, 2001

THE PRESERVATION TRADES NETWORK, a Task Force of the Association for Preservation Technology International and the National Park Service, Floyd Bennett Field, Jamaica Bay Unit, Gateway National Recreation Area, Brooklyn, NY will be hosting the 5th Annual International Preservation Trades Workshop (IPTW 2001) with the theme of "Partners in Preservation" on October 26 - 28, 2001 at Floyd Bennett Field, with a focus on the pragmatic hands-on application of historic preservation. For information: ken.follet@verizon.net, or visit www.ptn.org.

The Preservation Trades Network is also putting out a call for stone masons, timber framers and traditional roofers to take part in a volunteer project which involves building picnic shelters, etc. for the Ecology Camp for Urban Youth at Fort Bennett Field. This will be part of the program of the IPTW 2001. Interested stone masons should contact Drew Diaz, ddredge@WORLDNET.ATT.NET

October/November, 2001

DRY STONE TRAINING WORKSHOP

The Dry Stone Conservancy will conduct fall training workshops in Kentucky for beginning masons, and certification examinations for intermediate masons in October and November 2001. After August 31, please check the web-site www.DryStoneUSA.org newsletter page, for information and dates.

August, 2002

SWITZERLAND -DRY STONE CONFERENCE

A conference on Dry Stone Walling in the High Mountains will be presented by Swiss and French Dry Stone Walling organizations. For information: email: info@umwelteinsatz.ch

EXPERIENCED
STONE MASONS
Serious, committed apprentices. Full time, year round work. Benefits, health plan, paid holidays and vacations. Western Massachusetts and Northwest Connecticut. Send resumes for either position to Monterey Masonry, Box 58, Sheffield, Massachusetts 01257 or e-mail: masonry@bcn.net

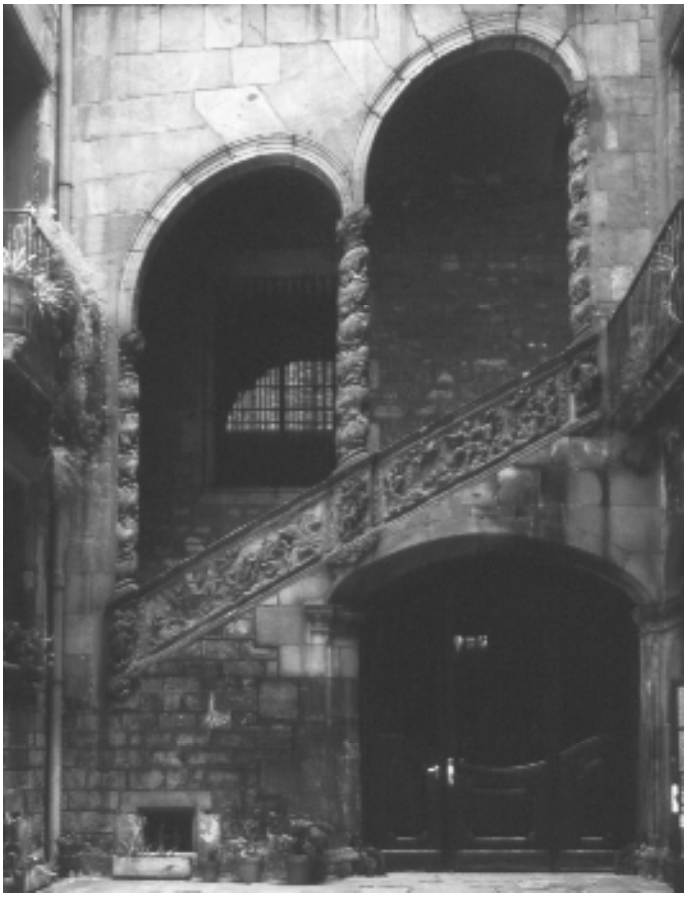
WANTED

C L A S S I F I E D
A D V E R T I S E R S
no experience necessary
plenty of space available
! ! only $2.00 per word ! !

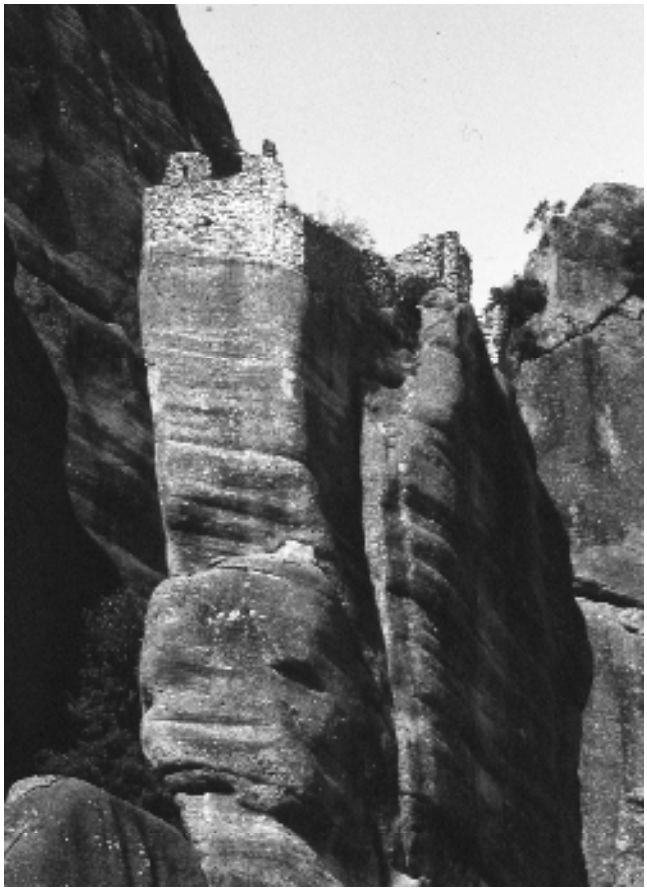
STONEXUS magazine
116 Lovato Lane
Santa Fe, NM 87505
tomas@stonefoundation.org

Granite sculpture by Eduardo Chillida, Basque artist, San Sebastian, Spain

Farmhouse, Fujian Province, China



Courtyard, Barrio Gotico, Barcelona, Spain



Monastery, Meteora, Greece
All men and materials were hauled up in baskets.